Handbook of Research on

Digital Transformation Management and Tools



Richard Pettinger, Alexandru A Roja, and Diana Claudia Cozmiuc

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Handbook of Research on Digital Transformation Management and Tools

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This chapter gives a holistic overview of digital transformation and its impact on firm performance and highlights the strategy firms can adopt to become sustainable in the long run. Digital transformation has become a well-known phrase that is often used to describe a major IT overhaul. New digital technologies provide the game-changing potential for and grave dangers to businesses that established their success in the pre-digital era. Customer engagement and digitized solutions are two critical digital strategies that give the necessary direction for a digital transformation in any firm. With advanced information and communication technology (ICT), enterprises may create new content, apps, or services to provide them with a competitive edge. A digital services platform and an operational backbone are important for implementing the firm's business strategies. Digital transformation can improve business performance and contribute to sustainability. Sustainability has become an entrenched and overarching aspect of strategic planning for firms.

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Because of the threat it poses to human health around the world, the COVID-19 pandemic has had devastating effects on the economies of all countries. Businesses had to change their business models, working conditions, marketing communication, technology usage, strategy development, and supply chain relationships in order to continue operations that had come to a halt. In order to realize this change in the best way, businesses have attempted to integrate digital tools into their business processes. As a result, the business world experienced a rapid digital transformation. Based on those, the purpose of this chapter is to investigate the impact of the rise of digital transformation on businesses during COVID-19.

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The existing literature and reports were reviewed for this purpose. It is thus discussed how businesses experienced digital transformation during COVID-19.

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Nurcan Alkış-Bayhan, Başkent University, Turkey

The improvements in digital technologies have changed societies in many ways. This process is commonly called "digital transformation." Many sectors have been affected by digital transformation, including higher education institutions. Also, the COVID-19 pandemic, which started in 2019 in China, triggered the use of digital technologies in everyday activities and at every level of education. This chapter primarily presents the process of digital transformation in higher education by giving examples from various countries based on recent research, providing challenges of digital transformation of higher education, and then examining the challenges and reflections of the COVID-19 pandemic on the digital transformation of higher education. Lastly, the current situation is evaluated, and suggestions are proposed.

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E-learning is an ever-changing concept, and many theories have been developed and studied for it. The common aptitude test for management schools in India started online in 2009, and almost all coaching firms, like testing firms, are migrating online. Furthermore, the current pandemic COVID-19 has required all participants in learning to be online for the previous year and a half. Therefore, the present study is designed to analyse the causal relationship of the factors affecting learners perceived-learning-outcomes-and-satisfaction of e-learning in the preparation of graduate admission tests. The results concluded that effective and constructive conversation among students, as well as between students and instructors, has a substantial and beneficial impact on learning outcomes. In addition, the course objectives and strategy, module structure, course content supplied to students, and grading component designs are all critical for an online class. The study is useful for e-learning educators, managers, and legislators.

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The e-commerce industry is continuously evolving and attained exponential growth as a result of the COVID 19-pandemic and the consequent lockdown. This has also generated possible changes in online consumer preferences. Although several studies have identified factors affecting online repurchase intention (ORI), a fresh look is required to identify key determinants of ORI. Thus, the current study, through extensive literature review, proposes and investigates such ORI determinants. Explanatory design with quantitative

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research method is used, and empirical data is collected using a self-administered e-questionnaire. A sample of 243 responses were collected from online consumers using snowball sampling. The data were then analyzed using AMOS 24 through series of statistical analysis. The findings show that web quality, service quality, credibility are key determinants of online repurchase intension. Electronic word of mouth (E-WoM) and customer relationship management (CRM) demonstrated insignificant impact on ORI. The results also identify perceived web quality as a factor with strongest impact on ORI.

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This chapter investigates the long-established ecological cognition framework and updates it to better account for the advances in digital transformation. To do this, two concepts are explored. The first, 'serendipity engineering for seductive hypermedia', looks at how to design information systems to account for the pleasant occurrences that happen in offline environments studied by those in sales and marketing where beneficial outcomes often occur by chance encounters. The second, 'user analysis using socialnomics', looks at how a parametric user model based on the ecological framework can be used to understand users of information systems from the point of view of supporting a digital economy of users. A number of additional equations are developed using socialnomics that can be applied to digital transformation based on the parametric user model, including to calculate probability of seduction and probability of serendipity in an information system. The parametric model presented has great applicability for information and communications technology solution providers.

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The main aim of this study is to analyze the use of social networks by young consumers and understand if they engage with brands online and if creative brand content impacts social network users and online shoppers. With the technological advances and intense use of smartphones, firms should consider connecting and standing out with their audience online. Implementing a specific social strategy on social media may be the way to go. This research uses a quantitative methodology with a survey questionnaire from Portuguese brand consumers. The results show that a creative social marketing strategy through a strong brand identity can positively affect clients if people use social media for entertainment.

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Information systems is a field that is highly relevant to the business environment. As a relevant concept, industry covers businesses that might have similar problems and processes. Problems and case studies from the industry are often covered in information systems publications. Considering the relevance of the industry concept, this chapter follows a scientometric approach to examine research interest from the information systems discipline towards sectors and industries. The approach depends on the industry codes involved in publication meta-data by EBSCO. Meta-data was collected for articles published in 20 information systems journals between 1996 and 2020. The results present an overview of relevant North American Industry Classification System (NAICS) sectors for selected information systems journals, as well as the most active journals by sector. A comparison of annual publication counts is presented, and the authors highlight the trends of research interest towards sectors.

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Aslı Diyadin Lenger, Istanbul Gelişim University, Turkey

In this chapter, the author tries to explain the metaverse and identify factors affecting it. The factors were identified as business models, healthcare, leisure activities and social life, economy, ownership, education, freedom or ethic, and art. Each of these creations were affected by the metaverse, and they will be the backbone of building the metaverse. Metaverse is a new phenomenon which is changing the whole digital and physical environment in a very near time. With this respect, the author builds a frame of how the metaverse changes the world. The findings suggested that the economy, marketing, businesses model, and individuals' lives will change dramatically.

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The aim of this study is to determine the influence of knowledge and use of accounting software (AS) among small business (SB), medium scale industry, cottage industry, entrepreneurship, and informal sectors in Kathmandu Valley. This study has used structured questionnaire with an interview. The data were evaluated quantitatively by using both descriptive and inferential statistics. Based on practical experience and basic knowledge in the field of accounting, a total of 210 members are selected as the sample size for the study. The findings revealed that the knowledge of AS has a significant effect on the use of AS, meaning that there is significant and positive relationship among the knowledge of generalized AS and the use of such customized AS by business in Kathmandu Valley. In addition, this study shows the empirical evidence of knowledge of AS effects on the adoption of AS among business sectors in Kathmandu Valley. The use of AS has resulted in a significant impact on business in developing countries like Nepal.

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Poshan Yu, Soochow University, China & Australian Studies Centre, Shanghai University, China
Heng Tang, The Intellectual Property School, Jiangsu University, China
Hao Tang, Independent Researcher, China
Emanuela Hanes, Independent Researcher, Austria

This chapter intends to examine the degrees of digitalization with several Chinese museums renowned for their IP creations in reflection of the combination of ancient Chinese culture and modern design thinking and to describe the transformation in Chinese digitalization. Attributing to some inclusive policies, museums are enforced to shift their functions for visitor engagement, which plays a role as a social service with non-profit ambition in improving the tourism economy and social welfare. Our understanding of the enabling and limiting mechanisms paves the way for more research on the paradoxical implications of transformative changes in practical enhancement in the Chinese cultural economy.

Chapter 12
Digital Transformation and Innovation Management: The Case of Small-Medium Enterprises in Lebanon..... 265
Khodor Shatila, IProCares International Research Center, Lebanon
Suha Jalloul, Lebanese American University, Lebanon

Transformational entrepreneurship refers to the capacity of entrepreneurs to deal with global difficulties, such as the current economic crisis, to enhance the well-being of their local communities. Digital technologies have impacted the connection between entrepreneurs and small and medium-sized enterprises (SMEs). The survey was distributed online using Google forms between December 2021 and February 2022. The target population for the study included entrepreneurs owning small-medium enterprises in Lebanon. Additionally, the sample that is used for this study is 270 entrepreneurs (N=270). As a result, this study contributes to the body of knowledge by examining the relationship between technical preparedness and market expansion and the investigation and use of that technology. Understanding the relationship between macro-level policy changes and the national level is essential. Ultimately, the findings might help encourage developing and implementing cutting-edge technology-driven business strategies.

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Rakesh Kumar, Deen Dayal Upadhyaya College, University of Delhi, New Delhi, India
Anil Kumar, Deen Dayal Upadhyaya College, University of Delhi, New Delhi, India

This chapter demonstrates how the digitalisation of welfare schemes aiming at marginalized people has proven to be an effective tool for socio-economic transformation in rural India. It aims to advance and offer the argument in favour of e-governance-led digitalization for the multidimensional benefits to the entitled beneficiaries in India. Digitalisation has facilitated the implementation of e-governance, leading the government in building all interconnected and interlinking nexuses of different segments of society through the use of ICT over the digital space.

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Investigating the "What" in Digital Transformation

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Maryia Zaitsava, University of Cagliari, Italy

User involvement is crucial for designing technological products with "real-world potential" in the digital transformation realm. The existing tacit consensus on user-driven innovation suggests users' proactive role in information sharing and rather a passive role of firms restricted mainly by users' information receiving. However, the importance of translating users' information into concrete technological product features and integrating new users' knowledge in the product development process is salient for firms. The present research theoretically derives the action-oriented framework based on the adapted linear communication model and empirically tests it in the context of technological product development within a startup. The study contributes to innovation management literature and co-creation research stream by enlarging understanding of the role of a firm in user-driven innovation. Furthermore, the study provides the action-oriented framework "listen-think-do" that enables the transformation of valuable users' information into firms' actions and new product development.

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Digital Transformations and the Importance of Business Models for Organizations: Digital Business Models – The Key for Success in Today's Business World 322
Lavinia Andreea Gruia, West Univesity of Timişoara, Romania
Nicolae Bibu, West University of Timişoara, Romania
Marian Năstase, Bucharest University of Economic Studies, Romania
Doina Dănăiață, West University of Timişoara, Romania
Nicoleta Cristache, "Dunărea de Jos" University of Galați, Romania

Digital transformation has become a key element for every organization, but in order to succeed, organizations must understand that this will also have an impact on their business model. In the end, what drives success for an organization is their business model, and currently, organizations must be able to innovate and digitalize their business models. This chapter is going to define the main digital business models and how organizations could apply and combine these archetypes and models in order to create hybrid business models or create their own innovative digital business model. The authors are going clarify why digital business models have emerged as a quintessence of innovations in digital technologies. Once an organization understands the connection that it can create using the power of digital technologies, it will be able to survive and thrive in the digital economy.

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Steven Wright, Georgia State University, USA

Digital transformation involves new concepts, radical innovation, and radical organizational change across multiple organizational dimensions. Blockchains can be considered a form of digital transformation for organizations. An aspect of the radical nature of blockchains flows from the capabilities it can provide for trustworthy transactions between organizations. This creates opportunities for new business models by disintermediation of some parties to traditional transaction flows in the same industry or supply chain. Multiple parties have to agree to adopt the new style of transactions. Scorecards and metrics for multiparty technology adoption have additional scope that metrics within a single organization do not. Organizational readiness and maturity metrics for effectively utilizing blockchains have to address the broad range of business considerations that management should consider when evaluating opportunities for digital transformation via blockchain.

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Debasish Roy, Sikkim University, India

This chapter has attempted to provide a strong structural foundation of the newly emerged economic model of moligopoly in the era of growing digitization. The explosive nature of digitization since the beginning of the first decade of 21st century has posed some major problems for the existing textbook economic models since they have failed to explain the market forms within which the "Big Tech" firms are operating. Going by the standard norms of non-collusive oligopoly models, these technological behemoths do not form reaction functions – although they display all the natural 'traits' of a monopolist. Thus, the new economic model of moligopoly may be defined as a hybridization of monopoly and oligopoly models, respectively. In this chapter, four major "Tech giants"; namely, Netflix, Microsoft, Facebook, and Google, are taken as sample firms for time series analysis to lay the foundation stone of moligopoly model and its related postulates.

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Özgecan Kalkan, Maltepe University, Turkey

The purpose of this chapter is to discuss two subfields of marketing, namely digital transformation and co-creation, that share common characteristics and possess key differences. The initial focus is on the digital transformation subfield, in terms of the definition, phases, strategies, business models and resource integration, and finally, the new technologies and platforms. Subsequently, the chapter provides in-depth information on the value co-creation subfield focusing on value definition, innovation and co-creation, and the service-dominant logic. Value co-creation and digital transformation have emerged because academics in both subfields have been discussing new questions raised by the advent of new technologies on how value from delivering new products and services can be captured. This chapter argues that these two subfields are converging to enable resource integration through similar sources such as platforms created through digital ecosystems. Working together, the two fields can improve their potential to find better solutions to improve the transformation process.

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Muazu Adeiza Umar, Abubakar Tafawa Balewa University, Bauchi, Nigeria

The objective of the chapter is to assess the role of digital transformation in small business management and specifically to evaluate the strategies suitable for small businesses, identify the underpinning theories, and highlight related empirical studies. Thus, several kinds of literature in the domains of information systems, strategic management, and small business management were extensively reviewed. It was discovered that small businesses are struggling with digital transformation. However, those that have adopted the system are benefitting immensely. It is therefore recommended that more attention be paid to those strategies that work well for small businesses; that tailor-made theories for small business digital technology adoption be developed; and more studies, specifically longitudinal studies, are required to appreciate the complexity of the problem and where interventions are required.

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Sakhhi Chhabra, Xavier School of Management, Delhi-NCR Campus, India

Technology is changing rapidly, which is constantly changing the status quo in people's lives. It is difficult for marketers to understand these accelerating changes and act on them. In this work, the author explores how the marketing discipline has evolved due to changing technologies over the years. The work first uncovers the major changes in technology and ponder the foundational concepts which have led to these technology changes. Then it reflects on these changes from a marketing lens and understand how the new concepts have emerged in the discipline. Further, the author dives into how the changes in marketing discipline have impacted consumer behavior and subsequently predict the directions in which the marketing discipline would evolve due to changes in technology. The contribution of this paper is a comprehensive literature review and development of a framework that links the changes in technology and resultant changes in consumer behavior which throws up new research agenda in technology-enabled marketing for academicians and Ph.D. scholars working in this area.

Chapter 21
The Impact of Disruptive Digital Technologies on Organizational Structures and Marketing Systems: Democratization of Marketing in the Solidarity Economy 469
Alpaslan Kelleci, Istanbul Gelisim University, Turkey

Disruptive digital technologies, such as Web 3.0 and 3D printing, have been instigating new organizational structures and by extension new marketing systems given that they change and evolve in response to technological and social changes. By capitalizing upon institutional theory, this chapter delineates how Web 3.0 technologies enable social change via global collaborative commons, which have the potential to ascertain distributive justice for public at large. It also prognosticates how the marketing discipline in Era V (2020-?) will have to go through a sea change to reproduce and carry itself to a further level if it does not want to face the risk of extinction.

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Andrea Sestino, University of Bari Aldo Moro, Italy
Ilaria Santarelli, University of Bari Aldo Moro, Italy
Cesare Amatulli, University of Bari Aldo Moro, Italy

The technology integration of luxury is a promising business opportunity. New technologies such as the internet of things, smart objects, artificial intelligence, the pervasive digitization of business processes, together with the shift of several business activities online are enabling unprecedented opportunities for luxury marketers and managers. Through qualitative research designs, this chapter would systematize knowledge about this topic with the means of a literature review. An amount of 224 contributions published in the last two decades (2010-2020) have been examined. Findings show current issues and opportunities on four promising topics: luxury hospitality, luxury fashion, luxury tourism, and luxury foods. Opportunities for scholars, marketers, and managers are examined together with implications for consumers' behavior studies.

Chapter 23
Bibliometric Analysis of Supply Chain Digitalization 489
Laurence Saglietto, Université Côte d'Azur, France
Jennifer Lazzeri Gracia-Campo, Aix Marseille Université, France
Federico Pigni, Grenoble Ecole de Management, Université Grenoble Alpes, France

"Digital transformation" or "digitalization" is a rapidly evolving concept that is gaining popularity in various different disciplines and highlighting a wealth of ideas, theoretical anchors, and research directions. In the present chapter, the authors try to understand the structure underlying research on supply chain digitization, the topics investigated which need more attention, how the existing literature could be classified, and how the discipline could be advanced. Using a bibliometric approach, this chapter analyzes 638 articles published between 1995 and 2020. The authors use VosWier to analyze the mapping information and Alceste for a detailed lexical analysis. The analyses reveal the main trends in supply chain digitalization and suggest an agenda for future research that includes a systemic approach to the analysis of digitalization, supply chain digitalization to create new strategic value, and digitalization as a dynamic capability.

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Digital Journalism and Transmedia Narratives in the Communication of Science: From Disruption to Reinvention 531
Juan-Ignacio Martin-Neira, Universidad de Granada, Spain
Magdalena Trillo Domínguez, Universidad de Granada, Spain & Grupo Joly, Spain
María-Dolores Olvera-Lobo, Universidad de Granada, Spain

Knowing what the best channels of information are in the digital ecosystem has become a great challenge for science journalism, especially in pandemic times and where social networks have given rise to greater dissemination and immediacy. New processes are constantly appearing that are reinventing the profession through disruptive actions, such as communication via transmedia narratives. This chapter presents an approach on how journalism has been developed in the digital age and, in particular, how science journalism is incorporating technologies, narratives, and formats to project its content. From here, an analysis model is proposed for evaluating the degree of transmedia innovation and evolution in science journalism, along with a number of guidelines and recommendations for implementation.

Chapter 25
The Low-Code Movement: Accelerating Digital Transformation With Low-Code 556
Cantemir Mihu, "Lucian Blaga" University of Sibiu, Romania

Low-code is one of many topics that have been brought up to address two perennial problems: the growing shortage of software developers and the methodological gap between business requirements and implementation. With low-code, you give business users and process owners the tools they need to build systems and make process improvements on their own, with minimal technical support. To be successful, digital strategy initiatives today and in the future will need to think of and include tools that empower their business users and help accelerate process automation. This chapter provides a general understanding of low-code platforms, explores the current research on the topic through a bibliometric analysis, and analyses the impact of low-code on digital transformation.

Chapter 26
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Dewi Tamara, Bina Nusantara University, Indonesia
Anita Maharani, Bina Nusantara University, Indonesia

This chapter is divided into an introduction, where it shows the background and importance of digital transformation; a second section, which is a discussion of pandemics and school-home situations, and the third, which gives the implications of digital transformation. This chapter will discuss some factors that must be considered before implementing digital transformation in education. Individuals and societies are undergoing a multifaceted transformation due to the information era we are now experiencing. The ownership of knowledge has migrated, and conventional ways of teaching and learning are being replaced by new approaches. In today's environment, both the production and acquisition of information are essential. There is growing evidence that generating and utilizing information is crucial to the success of a person, an organization, or a society's prosperity. Society must undergo fundamental transformations because of the greater use and generation of information.

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A Comprehensive Study on Gesture Detection: An Approach for Sign Language Interpretation Analysis 587
Rajamani P., GITAM University, India
Hyma J., GITAM University, India

The advent of technologies made our lives more comfortable with their rapid spread in various sectors like business, education, productive industry, marketing, health sector, and many more. Computer vision being an interdisciplinary field has a large scope of applications, and among them, object detection carries a vital role and has wide spread in various fields of study. Object detection exhibits a potentiality in numerous applications like image and video annotation, gesture detection, etc. In this regard, a preliminary research is carried out on sign language gesture recognition to review and facilitate the road map of earlier research findings. The work is carried with a focus on the recent developments and the enormous techniques and tools that were introduced to handle gesture recognition varying from mathematical models to deep learning models with its advantages and limitations. Issues like computational complexity and accuracy with respect to the various verticals of the sign language interpretation are explored and are listed with their remarkable outcomes.

Chapter 28
Citizen Participation in Law-Making in the European Union 605
Maria Jesus Garcia Garcia, University of Valencia, Spain

A regulatory policy based on the idea of smart regulation takes the view that legislation and regulations serve the economy, and therefore, laws must be intended to create the conditions to improve national economies and economic growth, as laid down by the OECD and the European Union itself. Such a regulatory policy is informed by a set of principles which apply to both regulatory institutions and regulations, such as transparency, cooperation, accountability, efficiency, effectiveness, participation, and openness. This regulatory approach takes the view that regulations are of better quality when they have been influenced by citizens. As a consequence, smart regulation results in participatory democracy. Citizens collaborate with the government in the lawmaking process at an early stage and throughout the lifecycle of a legislative act by means of consultations. This chapter focuses on consultation as the principal mechanism for participatory democracy in the context of smart regulation law-making in the European Union.

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Preface

Advances in digital technologies continue to impact all areas of life, including the business sector. Digital transformation is ascertained to usher in the digitalized economy and involves new concepts and management tools that must be considered in the context of management science and practice. For business leaders to ensure their companies remain competitive and relevant, it is essential for them to utilize these innovative technologies and strategies. The Handbook of Research on Digital Transformation Management and Tools highlights new digital concepts within management, such as digitalization and digital disruption, and addresses the paradigm shift in management science incurred by the digital transformation towards the digitalized economy.

Digital transformation may be defined as the global market giving the digital and the digitalized economy. According to Markets and Markets, the digital transformation market is valued at 521.5 billion in 2021 and anticipated to reach 1247.5 billion by 2026, at a compund annual growth rate of 19.1%. The main players on the digital transformation market are, according to this report: Microsoft, IBM, SAP, Oracle, Google, Cognizant, HPE, Adobe, Accenture, HCL Technologies, Broadcom, Equinix, Dell, Tibco, Marlabs, Alcor Solutions, Smart Stream, Yash Technologies, Interfacing, Kissflow, Emudhra, Process Maker, Process Street, Happiest Minds, Scoro, Brillio, and Aexonic Technologies. Other market analysts, Fortune 500, estimate the digital transformation market to part from higher USD 737.88 billion in 2020 at an annual compound growth rate of 22.1% and reaching 3,546.80 billion by 2028. The main market players are Amazon Web Services, Oracle Corporation, Microsoft Corporation, VMware, Inc., SAP SE, IBM Corporation, Salesforce.com Inc., HCL Technologies Limited, Wipro Limited, Accenture plc, Cisco Systems, Inc., Teradata Corporation, Cloudera, Inc., Tableau Software, Huawei Technologies Co., Ltd., Apple Inc., and NVIDIA Corporation. The reference market analyst, Statista, argues digital transformation is forecast to reach 1.8 trillion U.S. dollars in 2022 and to rise to 2.8 trillion U.S. dollars in 2025.

Information and communications technology solution providers are the sellers make a sellers and existing vertical markets to be digitally transformed are the buyers. Digital transformation is a decision for both parties: sellers make a strategic positioning decision and buyers make an investment in organizational change decision. Whereas the information and communications technology providers are the digital economy, they are complemented by digital platforms and services and their output is sold to existing industries to be digitally transformed in the digitalized economy. The industrial economy paradigm shifts to the digital economy paradigm, and impacts all economic sciences including management. From an epistemological view, a new paradigm in management science emerges and needs to be investigated with its new concepts, methodologies, tools and viewpoints. This new paradigm may be investigated in terms of fundamental questions: "Where does digital transformation occur?"; "Why digitally transform?"; "Who is involved in digital transformation?"; "What is included in digital transformation?"; "How is

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digital transformation implemented?"; "When implement the digital transformation decisions?". The answers to these questions reveal new empirical phenomena and new related academic research, such as new management tools.

This book intends to research the paradigm shift in management science incurred by digital transformation. The book will refer to digital transformation concepts, the decision, and point to the management instruments that answer basic W and H questions: "Where?", "Who?", "Why?", "What?", "How?", and "When?". These questions and answers to them will give the structure to this book.

The first objectives of the book refer to fundamental concepts, such as: digitalization, digital transformation as a management phenomenon, digital transformation as a market, digital disruption.

The question "Where to play in digital transformation?" opens several questions: "Which are the markets of digital transformation technologies?"; "Which are the existing and emerging technology markets?"; "Where to play in terms of geography?"; "Where to play in terms of product, product-service system, solution or outcome?"; "What are the use cases marketed between sellers and buyers?"; "What are the customer markets of digital transformation?" and triggers objectives about digital transformation market analyzes, transactions about products, services, solutions and relationships about value, outcome.

The next question is the "Who?": "Who are the major players in digital transformation, buyers and sellers?"; "Who within organizations manages digital transformation?". Objectives are to investigate digital transformation as a solution provided by the market players, as a management phenomenon at customers, as a transaction or relationship between market sellers and buyers in digital transformation.

The question "Why digitally transform?" unveils the rationale of digital transformation and spurs objectives about corporate governance; radical innovation driver- multiple innovations, disruptive innovation, architectural innovation; the VUCA environment and the digital transformation answer to it: the agile business model or the intelligent enterprise. Digital transformation involves new concepts, radical innovation, radical organizational change across multiple organizational dimensions and maturity stages, new project and pre-project management tools to implement digital transformation, new financial management tools which create a paradigm shift to the industrial economy. Digital transformation is a decision, at both sellers and buyers, and the decision management tools have empirical correspondence and relevance.

Digital transformation is of interest to academia, researchers, government, administration, institutions, the world economy, incumbents or start-ups in seller or buyers, industries, platforms, services, ecosystems, innovation centers or networks, new or reskilled professionals. The historically unprecedented, rapidly growing, global scale market impacts our lives in many ways. These impacts need to be considered in management science and practice.

The "Why?": research about corporate governance, for instance integrated reporting and its relation to digital transformation; new definitions of value, such as ecosystem or platform value and the relationship to digital transformation; new definitions of value and causal relationships in the logic model as inputs, outputs, outcomes, impacts and the role in digital transformation; new performance measurement; research about innovation and the of multiple innovation, architectural innovation, disruptive innovation and the relationship to digital transformation; research about the VUCA environment and operating models, such as the agile model and the intelligent enterprise; research about the VUCA environment and financial response, such as venture capital, real options theory, Opex vs Capex; systemic research about intangible assets, the intelligent enterprise, ecosystems, governance, valuation. Several articles refer to the rationale for digital transformation, be it stakeholder value: "Performance Management in Digital Transformation: A Strategy for Sustainability" or the Covid pandemic: "E-Learning Critical Success

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Factors in Graduate Admission Test: Impact on Perceived Learning Outcome and Learner Satisfaction", "The Digital Transformation of Higher Education and the Impacts of the COVID-19 Pandemic", and "The Rise of Digital Transformation Within Businesses in the Pandemic".

"Performance Management in Digital Transformation: A Strategy for Sustainability" gives a holistic overview of digital transformation and its impact on firm performance and highlights the strategy firms can adopt to become sustainable in the long run. Digital transformation has become a well-known phrase that is often used to describe a major IT overhaul. New digital technologies provide the game-changing potential for and grave dangers to businesses that established their success in the pre-digital era. Customer engagement and digitized solutions are two critical digital strategies that give the necessary direction for a digital transformation in any firm. With advanced information and communication technology (ICT), enterprises may create new content, apps, or services to provide them with a competitive edge. A digital services platform and an operational backbone are important for implementing the firm's business strategies. Digital transformation can improve business performance and contribute to sustainability. Sustainability has become an entrenched and overarching aspect of strategic planning for firms.

Digital transformation has been incentivized by the Covid pandemic, whether in education or business. Educators have had direct experience of digital transformation to refer to, as evidenced in two articles in this book. An unexpected digital transformation may be gamechanging in education for long. Digital business transformation has been accelerated by the pandemic. Book chapter "The Digital Transformation of Higher Education and the Impacts of the COVID-19 Pandemic" means businesses have had to change their business models, working conditions, marketing communication, technology usage, strategy development, and supply chain relationships in order to continue operations that had come to a halt. Based on those, the purpose of this chapter is to investigate the impact of the rise of digital transformation on businesses during COVID-19. The existing literature and reports were reviewed for this purpose. During COVID-19, it is thus discussed how businesses experience digital transformation.

The "Where?": research about global transformation markets from the global market analyses; vertical industry market analyses; existing market and emerging technologies market analyses; geographical market analyses; product-service solution transactional market analyses and value expertise or outcome-based relational market analyses; use case market analyses; vertical customer industry market analyses; relation to the digital or digitalized economy; core technology and market specific technology analyses; customer, government or business markets; the recommendation is to relate these analyses to each other. Answers to the question "Where?" show the omnichannel as medium, in chapters "A Fresh Look on Determinants of Online Repurchase Intention", "The Role of Social Media on Young Online Consumer Behavior", "Towards 'Serendipity Engineering for Seductive Hypermedia", "User Analysis Using Socialnomics: The Role of Ecological Cognition", and "Digital Transformation in the Digital World the Metaverse: The New Era on The Internet". Other chapters tackle the industries involved in digital transformation: "Focal Industries in Information Systems Research: A Scientometric Approach". Book chapters also include geographical analyses: "Digital Transformation and Innovation Management: The Case of Small Medium Enterprises in Lebanon", "Digitalization in Rural India: A Step Towards Socio-Economic Transformation Amid Pandemic", "Using 'Digitalization + Intellectual Property' Management to Realize Cultural Economy: Case Study of Chinese Museums", and "Understanding Adoption of Accounting Software in Business Sectors at Kathmandu Valley: Evidence From Structural Equation Modelling". These quantitative studies take a look at digitalization and digital transformation from a geographical perspective, revealing the socio-economic impact of the Information and Communications Sector that gives the digital and digitalized economy and the paradigm shift to be analyzed.

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Digitalization is centered on the Internet of Things which becomes the omnichannel for business activities and processes. An explanatory research, "A Fresh Look on Determinants of Online Repurchase Intention", tries to explain the online repurchase decision via factors affecting online repurchase intention (ORI), in theory and explanatory design with quantitative research method is used and empirical data is collected using self-administered e-questionnaire.

"The Role of Social Media on Young Online Consumer Behavior" aims to analyze the use of social networks by young consumers, understand if they engage with brands online and if creative brand content impacts social network users and online shoppers. This research uses a quantitative methodology with a survey questionnaire from Portuguese brand consumers. The results show that a creative social marketing strategy through a strong brand identity can positively affect clients if people use social media for entertainment.

Another chapter looks at Internet of Things technologies for the perspective of serendipity, "Towards 'Serendipity Engineering for Seductive Hypermedia' and 'User Analysis Using Socialnomics': The Role of Ecological Cognition", investigates the long-established ecological cognition framework and updates it to better account for the advances in digital transformation. To do this, two concepts are explored: 'serendipity engineering for seductive hypermedia' and 'user analysis using socialnomics'.

A number of additional equations are developed using socialnomics that can be applied to digital transformation based on the parametric user model, including to calculate probability of seduction and probability of serendipity in an information system.

One of the chapters has identified an emerging trend with high future potential: "Digital Transformation in the Digital World the Metaverse: The New Era on The Internet". In this chapter, the author tries to explain the Metaverse and identify factors affecting it. The factors were identified as, Business Models, Healthcare, Leisure Activities and Social Life, Economy, Ownership, Education, Freedom or Ethic and Art. Each of these creations were affected by the Metaverse, and they will be the backbone of building the Metaverse. Metaverse is a new phenomenon which is changing the whole digital and physical environment in what the author expects is a very near time. With this respect, the author builds a frame of how the metaverse changes the world. Findings suggested that the economy, marketing, businesses model and individuals' lives will change dramatically.

Digital transformation impacts industries in a different way, as noted in "Focal Industries in Information Systems Research: A Scientometric Approach". Problems and case studies from the industry are often covered in Information Systems publications. Considering the relevance of the industry concept, this chapter follows a scientometric approach to examine research interest from the Information Systems discipline towards sectors and industries, based on meta-data by EBSCO. Meta-data was collected for articles published in 20 Information Systems journals between 1996 and 2020. The results present an overview of relevant North American Industry Classification System (NAICS) sectors for selected Information Systems journals, as well as the most active journals by sector. Besides, a comparison of annual publication counts is presented with highlighting the trends of research interest towards sectors.

The "Who?": case studies or other research about the most important digital transformation market players: sellers, such as digital technology providers, digital consultants, digital service providers and buyers, such as manufacturing industries in Industry 4.0, energy industries, smart cities, banking, healthcare, IT and telecom, education, retail, media and entertainment, government, transportation and logistics

The "What?": research about organizational dimensions of digital transformation, such as digital technology as resource, data, information and knowledge as resources, other resources, governance, strategy, innovation, smart connected products, business model innovation, operating model, business processes,

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enterprise architecture, organizational structure, skills, culture, systems, style, staff; research about maturity indexes, generally accepted stages to date in literature review, the advancement of currently theorized maturity stages by the emerging technologies: digital twin, 6G or 7G, blockchain, artificial intelligence such as autonomous vehicles, additive manufacturing, robots, quantum computing and their impacts on digital transformation maturity and capabilities across several sectors; research about maturity indexes as the main instrument for the what in digital transformation; the mapping of the complex relationships that shape maturity indexes. The most important dimensions of digital transformation are technology and business models, as book chapters "Action-Oriented Framework for User-Driven Technology Innovation: A Firm Perspective" and "Digital Transformations and the Importance of Business Model for Organizations: Digital Business Model the Key for Success in Today's Business World" indicate. The "What?" of digital transformation is the capability maturity model: "Organizational Readiness/Maturity Considerations for Blockchain Adoption". Examples of technology is XBRL, whose adoption is tackled in the book chapter "The Low-Code Movement: Accelerating Digital Transformation with Low-Code". Other chapters deal with marketing: "The Impact of Disruptive Digital Technologies on Organizational Structures and Marketing Systems: Democratization of Marketing in Solidarity Economy" and "Infusing New Technologies in and Luxury: A Literature Review and Current Issues on Luxury Fashion, Food, and Tourism". Another functional area is supply chain management: "Bibliometric Analysis of Supply Chain Digitalization".

Book chapter "The Impact of Disruptive Digital Technologies on Organizational Structures and Marketing Systems: Democratization of Marketing in Solidarity Economy" highlights disruptive digital technologies, such as Web 3.0 and 3D printing, which have been instigating new organizational structures and by extension new marketing systems given that they change and evolve in response to technological and social changes. By capitalizing upon Institutional Theory, this chapter delineates how Web 3.0 technologies enable social change via Global Collaborative Commons, which have the potential to ascertain distributive justice for public at large. It also prognosticates how marketing discipline in Era V (2020 -?) will have to go through a sea change to reproduce and carry itself to a further level if it does not want to face the risk of extinction.

In another look at marketing, luxury is addressed in book chapter "Infusing New Technologies in and Luxury: A Literature Review and Current Issues on Luxury Fashion, Food, and Tourism". The technology integration of luxury is a promising business opportunity. New technologies such as the Internet of Things, smart objects, Artificial Intelligence, the pervasive digitization of business processes, together with the shift of several business activities online are enabling unprecedented opportunities for luxury marketers and managers. Though qualitative research designs this chapter would systematize knowledge about this topic with the means of a literature review. An amount of 224 contributions published in the last two decades (2010-2020) have been examined. Findings show current issues and opportunities on four promising topics about: luxury hospitality; luxury fashion; luxury tourism; and luxury foods. Opportunities for scholars, marketers and managers are examined together with implications for consumers' behavior studies.

Besides marketing, another functional area is tackled: supply chain management, in "Bibliometric Analysis of Supply Chain Digitalization". "Digital transformation" or "digitalization" is a rapidly evolving concept which is gaining popularity in various different disciplines and highlighting a wealth of ideas, theoretical anchors and research directions. In the present chapter, the authors try to understand the structure underlying research on supply chain digitization, the topics investigated which need more attention, how the existing literature could be classified, and how the discipline could be advanced. Us-

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ing a bibliometric approach, this chapter analyzes 638 articles published between 1995 and 2020. The authors use VosWier to analyze the mapping information and Alceste for a detailed lexical analysis. The analyses reveal the main trends in supply chain digitalization and suggest an agenda for future research that includes: a systemic approach to the analysis of digitalization, supply chain digitalization to create new strategic value, and digitalization as a dynamic capability.

In "Action-Oriented Framework for User-Driven Technology Innovation: A Co-Creation Perspective", user involvement is crucial for designing technological products with "real-world potential" in the digital transformation realm. The existing tacit consensus on user-driven innovation suggests users' proactive role in information sharing and rather a passive role of firms restricted mainly by users' information receiving. However, the importance of translating users' information into concrete technological product features and integrating new users' knowledge in the product development process is salient for firms. The present research theoretically derives the action-oriented framework based on the adapted Linear Communication model and empirically tests it in the context of technological product development within a startup. The study contributes to innovation management literature and co-creation research stream by enlarging understanding of the role of a firm in user-driven innovation. Furthermore, the study provides the action-oriented framework "Listen-Think-Do" that enables the transformation of valuable users' information into firms' actions and new product development.

Book chapter "Digital Transformations and the Importance of Business Model for Organizations: Digital Business Model the Key for Success in Today's Business World" argues digital transformation has become a key element for every organization, but in order to succeed organizations must understand that this will also have an impact on their business model. In the end what drives success for an organization is their business model, and currently organizations must be able to innovate and digitalize their business models. This chapter is going to define the main digital business models and how organizations could apply and combine these archetypes and models in order to create hybrid business models or create their own innovative digital business model. The authors are going clarify why digital business models have emerged as a quintessence of innovations in digital technologies. Once an organization understands the connection that it can create using the power of digital technologies, they will be able to survive and thrive in the digital economy.

Book chapter "Organizational Readiness/Maturity Considerations for Blockchain Adoption" highlights the multiple dimensions which digital transformation brings. Digital transformation involves new concepts, radical innovation, and radical organizational change across multiple organizational dimensions. Blockchains can be considered a form of digital transformation for organizations. An aspect of the radical nature of blockchains flows from the capabilities it can provide for trustworthy transactions between organizations. This creates opportunities for new business models by disintermediation of some parties to traditional transaction flows in the same industry, or supply chain. Multiple parties have to agree to adopt the new style of transactions. Scorecards and metrics for multiparty technology adoption have additional scope that metrics within a single organization do not. Organizational readiness and maturity metrics for effectively utilizing blockchains, have to address the broad range of business considerations that management should consider when evaluating opportunities for digital transformation via blockchain.

Book chapter "The Low-Code Movement: Accelerating Digital Transformation With Low-Code" shows low-code is one of many topics that have been brought up to address two perennial problems: the growing shortage of software developers and the methodological gap between business requirements and implementation. This chapter provides a general understanding of low-code platforms, explores the

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current research on the topic through a bibliometric analysis, and analyses the impact of low-code on Digital Transformation.

The "How?" and "When?": are answered by innovation as the strategy for digital transformation, be it related to digital strategy, the dual innovation strategy, the smart innovation strategy, the Product Lifecycle Management strategy, the platform and as a service business model innovation; by business models, operating models, digital enterprise architecture; by project management tools such as roadmaps, programs, projects, operations, use cases, business cases; by pre-project management tools such the lean start-up, discovery driven planning. Strategy itself may be the how in digital transformation. Several articles reveal the role of strategy in digital transformation: "An Essay on Moligopoly Model: A Passage to the New Frontier of Digital Economy", "Co-Creating Digital Transformation", and "Digital Transformation Strategies for Small Businesses Management". The core of strategy, competitive advantage is tackled by the former two chapters. Other chapters tackle digital transformation analytically, too: "Infusing New Technologies in and Luxury: A Literature Review and Current Issues on Luxury Fashion, Food, and Tourism"; "Digital Journalism and Transmedia Narratives in the Communication of Science: From Disruption to Reinvention"; "Digital Transformation in Education: Creating Lost Generation"; "A Comprehensive Study on Gesture Detection: An Approach for Sign Language Interpretation Analysis"; "Citizens' Participation in Law-Making in the European Union".

"An Essay on Moligopoly Model: A Passage to the New Frontier of Digital Economy" is a research paper that has attempted to provide a strong structural foundation of the newly emerged economic model of moligopoly in the era of growing digitization. The explosive nature of digitization since the beginning of the first decade of 21st century has posed some major problems for the existing textbook economic models since they have failed to explain the market forms within which the "Big Tech" firms are operating. Going by the standard norms of non – collusive oligopoly models, these technological behemoths do not form reaction functions – although they display all the natural 'traits' of a monopolist. Thus, the new economic model of moligopoly may be defined as a hybridization of monopoly and oligopoly models respectively. In this article, four major "Tech Giants", namely Netflix, Microsoft, Facebook, and Google are taken as sample firms for time series analysis to lay the foundation stone of moligopoly model and its related postulates.

"Co-Creating Digital Transformation" purposes to discuss two subfields of marketing, namely digital transformation, and co-creation, that share common characteristics and possess key differences. The initial focus is on the digital transformation subfield, in terms of the definition, phases, strategies, business models and resource integration, and finally, the new technologies and platforms. Subsequently, the chapter provides in-depth information on the value co-creation subfield focusing on value definition, innovation and co-creation, and the service-dominant logic. Value co-creation and digital transformation have emerged because academics in both subfields have been discussing new questions raised by the advent of new technologies on how value from delivering new products and services can be captured. This chapter argues that these two subfields are converging to enable resource integration through similar sources such as platforms created through digital ecosystems. Working together, the two fields can improve their potential to find better solutions to improve the transformation process.

"Digital Transformation Strategies for Small Businesses Management" purposes to assess the role of digital transformation in small business management and specifically to evaluate the strategies suitable for small businesses, identify the underpinning theories, and highlight related empirical studies. Thus, several kinds of literature in the domain of information systems, strategic management, and small business management, were extensively reviewed. It was discovered that small businesses are struggling

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with digital transformation. However, those that have adopted the system are benefitting immensely. It is therefore recommended that more attention be paid to those strategies that work well for small businesses; that tailor-made theories for small business digital technology adoption be developed; and more studies, specifically longitudinal studies, are required to appreciate the complexity of the problem and where interventions are required.

"Infusing New Technologies in and Luxury: A Literature Review and Current Issues on Luxury Fashion, Food, and Tourism" argues that the technology integration of luxury is a promising business opportunity. New technologies such as the Internet of Things, smart objects, Artificial Intelligence, the pervasive digitization of business processes, together with the shift of several business activities online are enabling unprecedented opportunities for luxury marketers and managers. Though qualitative research designs this chapter would systematize knowledge about this topic with the means of a literature review. An amount of 224 contributions published in the last two decades (2010-2020) have been examined. Findings show current issues and opportunities on four promising topics about: luxury hospitality; luxury fashion; luxury tourism; and luxury foods. Opportunities for scholars, marketers and managers are examined together with implications for consumers' behavior studies.

"Digital Journalism and Transmedia Narratives in the Communication of Science: From Disruption to Reinvention" argues that knowing what the best channels of information are in the digital ecosystem has become a great challenge for science journalism, especially in pandemic times and where social networks have given rise to greater dissemination and immediacy. New processes are constantly appearing that are reinventing the profession through disruptive actions, such as communication via transmedia narratives. This chapter presents an approach on how journalism has been developed in the digital age and, in particular, how science journalism is incorporating technologies, narratives and formats to project its content. From here, an analysis model is proposed for evaluating the degree of transmedia innovation and evolution in science journalism, along with a number of guidelines and recommendations for implementation.

"Digital Transformation in Education: Creating Lost Generation" is divided into introduction , where it shows the background and importance of digital transformation; the second is a discussion of pandemics and school-home situations, and the third is implications of digital transformation. This section will discuss some factors that must be considered before implementing digital transformation in education. Individuals and societies are undergoing a multifaceted transformation due to the information era we are now experiencing. The ownership of knowledge has migrated, and conventional ways of teaching and learning are being replaced by new approaches. In today's environment, both the production and acquisition of information are essential. There is growing evidence that generating and utilizing information is crucial to the success of a person, an organization, or a society's prosperity. Society must undergo fundamental transformations because of the greater use and generation of information.

"A Comprehensive Study on Gesture Detection: An Approach for Sign Language Interpretation Analysis" argues the advent of technologies made our lives more comfortable with their rapid spread in various sectors like business, education, productive industry, marketing, health sector and many more. Computer vision being an interdisciplinary field has a large scope of applications and among them object detection carries a vital role and has wide spread in various fields of study. Object detection exhibits a potentiality in numerous applications like image and video annotation, gesture detection, etc. In this regard a preliminary research is carried out on sign language gesture recognition to review and facilitate the road map of earlier research findings. The work is carried with a focus on the recent developments and the enormous techniques and tools that were introduced to handle gesture recognition varying from

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mathematical models to deep learning models with its advantages and limitations. Issues like computational complexity and accuracy with respect to the various verticals of the sign language interpretation are explored and are listed with their remarkable outcomes.

"Citizen Participation in Law-Making in the European Union" means a regulatory policy based on the idea of smart regulation takes the view that legislation and regulations serve the economy and, therefore, laws must be intended to create the conditions to improve national economies and economic growth, as laid down by the OECD and the European Union itself. Such a regulatory policy is informed by a set of principles which apply to both, regulatory institutions and regulations, such as transparency, cooperation, accountability, efficiency, effectiveness, participation and openness. This regulatory approach takes the view that regulations are of better quality when they have been influenced by citizens. As a consequence, smart regulation results in participatory democracy. Citizens collaborate with the government in the lawmaking process at an early stage and throughout the lifecycle of a legislative act by means of consultations. This paper focuses on consultation as the principal mechanism for participatory democracy in the context of smart regulation law-making in the European Union.

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Section 1

Investigating the “Why” in Digital Transformation

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Chapter 1
Performance Management in Digital Transformation:
A Strategy for Sustainability

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ABSTRACT

This chapter gives a holistic overview of digital transformation and its impact on firm performance and highlights the strategy firms can adopt to become sustainable in the long run. Digital transformation has become a well-known phrase that is often used to describe a major IT overhaul. New digital technologies provide the game-changing potential for and grave dangers to businesses that established their success in the pre-digital era. Customer engagement and digitized solutions are two critical digital strategies that give the necessary direction for a digital transformation in any firm. With advanced information and communication technology (ICT), enterprises may create new content, apps, or services to provide them with a competitive edge. A digital services platform and an operational backbone are important for implementing the firm's business strategies. Digital transformation can improve business performance and contribute to sustainability. Sustainability has become an entrenched and overarching aspect of strategic planning for firms.

INTRODUCTION

The enormous potential and omnipresent usage of digital technology have encouraged organizations to gain sustainable competitive advantages and increase their capacity to take full advantage of the benefits of digital transformation. Digital transformation (DT) has emerged as a significant topic in strategic

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information systems research (Günther et al., 2017; Loebbecke & Picot, 2015; Vial, 2019) and also for practitioners in recent years. To put it simply, digital transformation is the result of the significant changes occurring in society and industry as a result of the widespread use of digital technologies at the highest levels of the organization. As suggested by some researchers such as Matt et al. (2015) and Kaplan & Norton (1996), organizations need to discover methods to innovate through these technologies by devising "strategies that embrace the implications of digital transformation and drive better operational performance". Consumer expectations and behaviors have been fundamentally changed due to digital transformation (Kelley, 2018) and the resulting business model innovation, which has put pressure on conventional businesses and disrupted many industries (Shrivastava, 2017).

Every customer leaves a "digital footprint" (Günther et al., 2017). Compilation of their day-to-day online activities that accumulate across many platforms and devices provides firms with unprecedented insights into customer behavior and underlying opportunities. For example, purchasing history may be linked with similar customers' purchasing behavior to recommend online shoppers what they may want and when (Elvy, 2018). Digital technologies empower end-users by availing more information at their disposal (Verhoef et al., 2017). Their expectations go up as they see their capabilities go up in terms of communication and options to browse and process more information to make informed decisions. This technological penetration, a paradigm shift of services and digital readiness of consumers' cause change in consumer behavior as well as expectations. The growing demand of getting things done as much as possible from mobile applications, less use of hard cash, online ordering and delivery, and online customization of services are examples of how people change their behaviors (Wasan, 2018) and expect firms to meet those requirements.

Digitalization has an impact on overall customer service. Great customer experience requires a rapid response time to customer inquiries, which is possible by consolidating client data throughout the company into a single source (Pappas et al., 2018). With the collection and centralization of all accessible data, customer support services can easily and promptly answer customer's queries. Therefore, customer satisfaction improves because of the improvements in customer service and assistance. On the other hand, organizations may get a better knowledge of their client base by analyzing customer inquiries and responding to them. Organizations may profit from process digitalization in addition to the change of the customer experience (Blumenthal, 2017). However, although the digital transformation of internal processes may not immediately result in apparent improvements in profitability, it will provide many advantages to the company in the long run (Scott et al., 2017). The goal of digital transformation is to increase efficiency while also increasing connectivity. One of the most important goals for businesses is to improve business performance. When it comes to an organization's operations, automation of transactions, supply chain and human resource activities are common. Businesses that want to take their digital strategic vision to the next level should focus on improving cooperation among workers at all levels, as well as improving performance management. The digital transformation framework allows substantial gains in efficiency for transactional supply chain operations (Sundaram et al., 2020).

Consumers now have access to dozens of media channels, interact actively and easily with businesses and other consumers, and experience an ever-increasing number of touchpoints throughout their customer journey, most of which are digital. For instance, online merchants do not confine their reach to the conventional retail sector; they utilize their digital capabilities to penetrate industries previously believed to be irrelevant to retail in pursuit of new growth possibilities (Leu & Masri, 2021). Many of the more conventional companies have been toppled by digital upstarts (Karimi & Walter, 2015), who have used innovation to accelerate growth. This has negatively impacted many traditional businesses.

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However, a complicated approach to digital transformation and incompleteness of knowledge may impede companies' performance, making it difficult to handle digital transformation problems without functional, operational, and strategic efforts.

On the one hand, customer expectation is forcing businesses to adopt digital technologies to deliver their services, and on the other hand, digital technologies disrupt markets by lowering the bars to entering the market. It has given rise to new service offerings that focus on the market share of existing businesses and operate in completely different forms. For example - UBER competes with the taxi business without owning its vehicles (Jordan, 2017), Airbnb competes with the hotels and accommodation business without owning actual houses and hotels (Dogru et al., 2020). As the digital technologies enable significantly minimal marginal cost for additional user service, firms can compete fiercely on prices, as seen in telecom industries. For example, JIO in India significantly reduced the cost of mobile internet (Curwen et al., 2019) and grabbed a larger portion of the Indian telecom market in a short span of time.

The digital transformation has an all-around impact on the firm and the environment where it operates. The impact on the firm itself is intuitive. This impact ranges from a change in basic day-to-day routine tasks to the core strategy and functionality of the firm (Schwertner, 2017). Broadly these impacts can be categorized into financial and non-financial impacts (Nwankpa & Roumani, 2016). These two impacts can be isolated in some cases, but they are often intertwined and hard to delineate. As impacts are sensed within the organization or outside, firms take proactive or reactive actions to capitalize on or cope with the situation. These responses are broadly termed strategic responses. It varies from developing everything organically in-house to outsourcing everything. The word 'everything' has been used purposefully because it can include almost any form of digital transformation activities, from planning the digital transformation to executing, measuring, and reiterating the process. Digital Transformation is not just about retrofitting processes with technologies but preparing people, tinkering, or rebuilding the business model and value creation process (Reis et al., 2018).

In summary, this chapter gives a holistic overview of how digital transformation leads to better performance in many aspects. In this information era, an organization's digital transformation is not only a dire requirement; rather, but it is also the need of the hour. Organizations must have to embrace digital transformation if they want to remain in the business sustainably. Digital transformation helps them to reach new customer segments and unexplored markets effectively. The digital transformation of the business model necessitates the continuous innovation of goods and services to satisfy the ever-increasing demands of customers. Being digital means being nimble and responsive. This proposed chapter will demonstrate how digital transformation is both a driver and a precursor of long-term sustainability. To survive the digital revolution, satisfy market expectations, and create smart and inclusive societies, businesses must improve their digital capabilities while also evaluating their economic, environmental, and social performance. Integrating sustainability and digitization into a business strategy involves structural changes at the organizational level, as well as a shift in the function that a firm must play within a business ecosystem.

The entire chapter is organized into 8 sections. Next, after the introduction, the methodology section describes how this study is planned and conducted. The next section, "nature of digital technologies," talks about different digital technologies, their components, and their importance in the DT. After that, digital technologies as a source of disruption present disruptions caused by digital transformation and digital technologies. After that, the next section explains the impact of digital transformation on firm performance, followed by the performance management in the digital transformation section, where the

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chapter describes why performance management is crucial in DT. The next section talks about sustainability aspects of DT, followed by the conclusion section.

METHODOLOGY

This study followed a systematic review as outlined by Kraus et al. (2020) and Tranfield et al. (2003) to achieve the aim of structuring extant research on digital transformation in the areas of business performance and its management to achieve sustainability. This procedure included the following two steps: (1) planning the study, and (2) conducting the study.

Planning the Study

A strategy for performing a literature review was developed, which served as the basis for the study's inclusion and exclusion criteria. In order to compile this study, relevant articles were searched and compiled from various online databases, including the Web of Science (WoS), Scopus, ScienceDirect, reports and case studies available online. The methodology and processes followed by the authors of this research were diverse. For the purpose of determining the theme evaluation of the research on DT and Performance Management in the areas of business and management, the authors looked at the annual distributions of the papers involved, the number of citations, the names of authors who were the most frequently cited, as well as the journals in which the papers were published, among other things.

Conducting the Study

Further explanations of how relevant articles were discovered are provided in this section. This section also contains information regarding the final number of articles that were included in the investigation. In order to find relevant publications, the following phrases were used in the title, abstract, or keywords of the articles:

TS = (Digital Transformation AND Performance AND Sustainability).

This search criteria filtered 90 best matching articles that had all these topics. The articles were refined according to their genre, such as article or review, and according to web of science categories, such as business or management. The articles' language of choice was English.

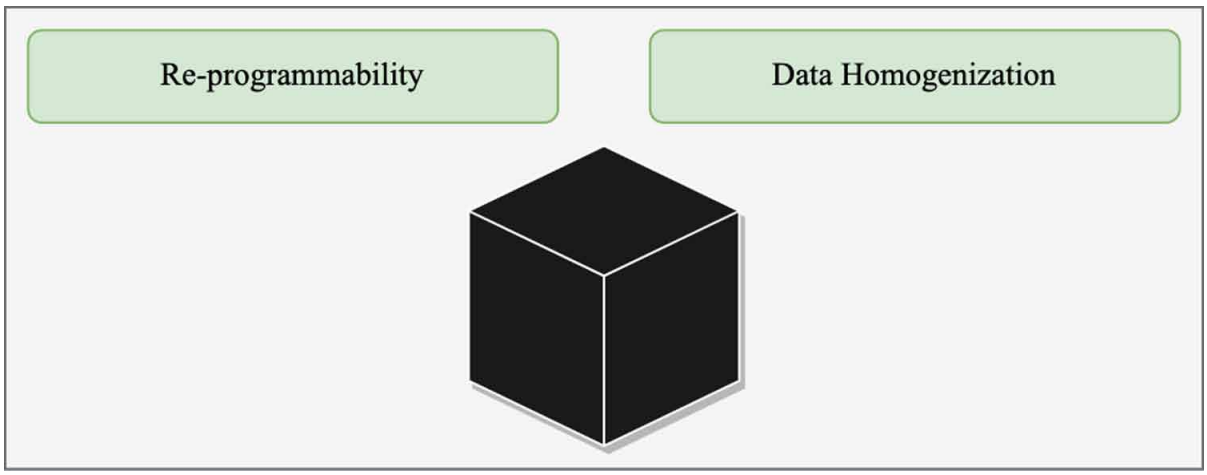
THE NATURE OF DIGITAL TECHNOLOGIES

This section of the chapter deals with the distinctive characteristics of digital technologies and their role in digital transformation. The word "digital technology" is a somewhat broad concept and given that practically everything we do nowadays is dependent on computers in some manner. It includes web-based or mobile-based, commercial, or free software solutions that can range from simple desktop solutions to complex and intelligent ERPs and integrated systems (Hadhoud & Salameh, 2020; Venkatesh, 2016). For the majority of people, digital technology is a mysterious black box (Hynes, 2018). This chapter at-

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tempts to open the black box of digital technology here in a way that aligns with (Orlikowski & Iacono, 2001) fourth perspective of technology - the computational view - in which the focus is "primarily in the capabilities of the technology to represent, manipulate, store, retrieve, and transmit information, thereby supporting, processing, modelling, or simulating aspects of the world." Yoo et al., (2012), assert that "basic characteristics of digital technology are re-programmability and data homogeneity (figure 1)."

Figure 1. Black-box view of digital technology.
Source: Author



Digital technology may be reprogrammed (Chowdhury & Akesson, 2011; Yoo, 2012). Smartphones with applications are the best example of re-programmability, wherein generativity is done by establishing a platform that allows third-party developers to add innovations into the platform. Besides re-programability, data homogenization is backbone of digital technology. Because all digital technologies deal with 0s and 1s, all digital technologies, at the very least in principle, are capable of handling any data. This means that the content has been separated from the medium (Yoo et al., 2010). Data homogenization is the fundamental reason people use a single device, such as a computer or a mobile phone, to do a variety of tasks

Yoo et al. (2010) suggested a modular design for digital technologies, consisting of four layers: service, content, network, and device as shown in table 1. Firstly, from a technological standpoint, the device layer considers the fact that digital technologies need underlying devices to carry out their activities. The network layer explains the interplay of digital technologies with their socio-technical context in more depth. Moreover, data, which is transferred across networks, is a critical resource for all digital technologies. Next, the content layer describes the data that has been received and delivered and defines how that data will be utilized and handled. Finally, the service layer encapsulates the goal of digital technologies via the lens of its application functionality (Arthur, 2009).

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Table 1. Multi-layer classification of digital technologies.

Layer	Dimension	Characteristic					Exclusivity
Service	Human Involvement	Active Usage			Passive Usage		ME
Content	Data Treatment	Collection	Aggregation	Analysis	Execution	Transmission	NE
	Input	Digital			Physical		NE
	Output	Digital			Physical		NE
Network	Multiplicity	One-to-One		One-to-Many		Many-to-Many	ME
	Direction	Uni-directional			Bi-directional		ME
Device	Role of Technology	Application			Infrastructure		ME
	Scope	Cyber			Cyber-Physical		ME
* ME: Mutually Exclusive; NE: Non-Exclusive							

Source: Adapted from Berger et al. (2018)

DIGITAL TECHNOLOGIES AS SOURCES OF DISRUPTION

Digital disruption is the shift in the value proposition of current products and services caused by new digital technology and business models (Riemer et al., 2015). In many industries, disruption (whether digital or otherwise) occurs on a large scale, causing an abrupt and dramatic change in profitability from one prevalent business model to a more profitable one (Riemer et al., 2015). The new models often give the same or greater value at a cheaper cost. Digital disruption usually follows a digital breakthrough like big data, machine learning, IoT, or the "bring your own device" (BYOD) trend (Case et al., 2019). Consumer expectations and behaviors vary as a result of digital innovation, prompting firms to alter the way they develop goods and services, generate marketing materials, and assess customer feedback (Chanias, 2017). This change in digital strategy can affect people, businesses, industries, or the whole world. For instance, On-demand services, such as Uber, have caused significant disruption in more conventional businesses, such as taxis. Since the advent of electronic reading, the print and publishing industries have been completely transformed.

It is the process of creative destruction that new and better processes replace the older ones. 51% of executives surveyed by Forbes reported that there is a high-risk technology-driven disruption (Team, 2018). 71% of companies surveyed have digital transformation projects in progress to tackle this risk (Morgan, 2019). Adopting a digital strategy is not easy, especially for the pre-existing ones. Only 38% of traditional companies did it successfully (Team, 2018). The pace of transformation and its challenges are unique by sector. Finance is the fastest transforming sector, followed by manufacturing, retail, and healthcare (Mortleman, 2018). Similarly, the pace of digital transformation varies across the countries. The differences between developing and developed countries are contrasting, as seen in figure 2. Countries like Nigeria and Ethiopia are at the lowest level of digital momentum and evolution, whereas the countries like Singapore and United States are at the highest maturity level of digital momentum and evolution (Chakravorti et al., 2020).

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Figure 2. Digital Evolution: State & Momentum
Source: Adapted from Chakravorti et al. (2020)



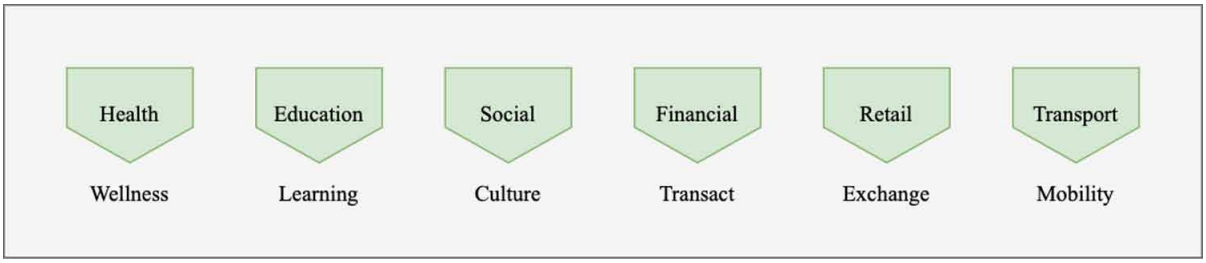
Companies that did not embark on a digital transformation journey or have no plans will not survive for a longer period in the market, and their sustainability is dubious. Nokia and HMT (watch manufacturer) are some examples of it. They did not go along with the pace of digital transformation. These companies are either running at a loss or about to become extinct. Moreover, by their very nature, digital technologies are disruptive (Karimi & Walter, 2015). According to Vial (2019), disruptions can root from-

1. Increasing the availability of data- Currently, businesses operate in a hyperconnected environment wherein every kind of interaction generates a massive amount of business and customer related data (Günther et al., 2017). Businesses may use this information to establish baselines and benchmarks for their transformation journey, and it serves as an excellent indication of progress. All of the data collected helps firms do things they could not before, such as - spot market patterns, better manage risks, and improve productivity; all of which will add value to the business in terms of operational as well as financial performance (Acito & Khatri, 2014; Evans & Lindner, 2012). The usefulness of data to create more sustainable solutions is enormous for organizations. For example, artificial intelligence might release up to $127 billion in value by 2030 by reducing food waste, preserving resources, and renewing natural systems (Foundation, 2019).
2. Altering Consumer Behavior and Expectations- Human needs evolve through time as their lifestyles and behaviors change. Because of the increased digital literacy and availability of services through digital channels (e.g., mobile phones and computers) consumers nowadays are not captive to one firm or service provider (Lucas Jr et al., 2013; Sia et al., 2016). Furthermore, consumers have access to several service providers at their fingertip, and in reality, their expectations of the services

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that should be given to them are rising as time goes on. This change in consumer behavior drives firms to adopt digital transformation and dispense their services through digital channels (Sia et al., 2016).

Figure 3. Human's needs or wants in an evolving digital world
Source: Adapted from Shrivastava (2017)



3. Disrupting Competitive Landscape- Digitalization has shifted the business paradigms while improving the quality of products and services (Yoo et al., 2010). As digital technologies like the IoT, Blockchain, and augmented reality become more widely used, digitalization is reshaping our personal lives and business practices on a global scale (Berger et al., 2018). Digital technologies change the way businesses work in the marketplace (Mithas et al., 2012). Digital technologies facilitate and recombine the existing product and services offering into a new form of digital offering (Vial, 2019). Taking the music business (Lucas Jr et al., 2013) as an example, tangible commodities sold via intermediary have been superseded by music subscription services provided by companies that were not initially part of the industry (e.g., Apple, Google). As digital technology increasingly replaces traditional working methods, more businesses are developing digital systems that are extremely responsive and capable of delivering products from the manufacturing plant to the customer as soon as orders are received.

IMPACTS OF DIGITAL TRANSFORMATION ON FIRM PERFORMANCE

Firm performance (FP) can be understood as the comparative measurement between firms about how well these firms met their primary objectives (Cao & Zhang, 2011). There are various metrics to measure the firm performance (Delen et al., 2013; Düzakin & Düzakin, 2007; Straub et al., 2004). Generally, profitability, growth and market value are associated with superior firm performance (Cho & Pucik, 2005). Studies have been directed towards understanding the causal relationship between the firm performance and explaining the variations in performance among competing businesses (Kaplan & Norton, 1996; March & Sutton, 1997).

Though the direct evidence of digital transformation and firm performance is not so apparent (Dale Stoel & Muhanna, 2009), it is undeniable that IT capabilities are core to firm performance (Nwankpa & Roumani, 2016). With digital transformation, firms are seeing performance improvement on various fronts like speed of service creation and delivery, convenience (Verhoef et al., 2007), information acquisition, processing, and generating actionable insights. Digital transformation is allowing us the

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abilities to conduct business and activities that were previously deemed impossible like personalizing the experience of services (Ansari & Mela, 2018), targeting the very particular group of customer segments, collecting, and processing the humongous data, automating the intelligence and so on. With all these extra abilities, firms tend to be robust in their actions, optimal on their expenses and gain additional financial revenues. While there are immense positive potentials for business from digitalization of its artifacts and process, the transformation itself is not simple and straight forward journey (Wimelius et al., 2021). The incorrect execution of DT can have severe negative consequences (Matt et al., 2015).

Strategic Responses to Digital Disruption

The speed of digital innovations and customers' preferences of digital channels and products push the businesses to either digitalize their services for utmost customer ease and satisfaction or get replaced by new digitally enhanced competitors. Transforming a business raises many questions. Firstly, how have businesses adapted their strategies, capabilities, and resources to respond to the challenges posed by digital disruptions (Oliver, 2018)? Additionally, how have their responses to the digital threat impacted their firm performance (Oliver, 2018)? The strategic response includes management of tangible and intangible resources to attain a competitive advantage in the dynamic environments (Oliver, 2018). Here tangible resources can be an investment in new organizational processes, forming strategic alliances, product innovation etc. (Teece et al., 2016), whereas intangible resources include managerial cognition, aspirational corporate strategy, effective communication, and motivation etc. (Colapinto, 2010).

In transforming the business to meet the customers' digital needs, businesses tend to bring many positive and negative impacts in their businesses. Firms that align their resources, structures, and strategies to changing environments can have a significant positive leap in firm performance (Eunni et al., 2017). With omnipresence, firms can harvest more revenues through more transactions happening with more customers in multiple channels that was not viable before (Leu & Masri, 2021). Additionally, the operations get leaner and faster on many fronts as the processes get automated, intelligent, and human error-free (Kelley, 2018). The precision of the business actions gets more accurate in targeting the market segment or conducting any other forms of operational business. With the enhancement of data collection and processing technologies, businesses that adopt these technologies have better insights into their past, present, and future (Evans & Lindner, 2012). On the other hand, sometimes, the business's strategic response fails miserably. The change resistance, limited resources to adopt the changes and incompetent leadership cause such failures. The impact can range from financial loss to the existential crisis (Visnjic Kastalli & van Looy, 2013).

Digital Transformation as Means of New Value Creation

With the advent of digital technologies, previously deemed impossible things just become viable. Remote working, virtual conference, creation, and delivery of services with minimal human intervention, humongous data processing etc. are some examples. With these new capabilities, firms have uncovered new opportunities (Reinartz et al., 2019a). Lots of digital innovations are happening, bringing new ways of creating values. Digital Banks in Hongkong found their foothold in capital intensive banking business without having any physical branches at all, purely with digital presence and collaboration between the pre-existing banks and regulators (Shek & Yung, 2021). Pure research on digital technologies is bringing up innovative products and services that allow us to do almost everything online (Arthur, 2009). Such

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activities obviously bring a positive impact on the entire economy with the new value creation and new opportunities (Jawad et al., 2021). But it is also undeniable that many digital transformation projects fail resulting in financial loss and sometimes threatening the existence of the firm itself (Andriole, 2020).

Automation, Individualization, Ambient Embeddedness, Interaction and Transparency, and Control are the five new sources of value creation in the digital world (Reinartz et al., 2019a). Developments in IoT, Robotic Process Automation (RPA), software programming has created values in business operation and consumer life through convenience and speed of service delivery (Kelley, 2018) through automation. Optimization and accuracy of actions like setting the thermostat, controlling refrigeration, lightbulbs, etc. are other value-added forms through automation. Here optimization contributes to monetary savings as well. Personalization of products and services is another source of value creation. With the capability to collect data from a multitude of sources about the individual and process them to understand the individual requirement, tailor-made services are created and delivered (Chen & Iyer, 2002). With personalization, heterogeneous preferences are addressed (Ansari & Mela, 2018), creating additional value for customers as their preferences are matched (Simonson, 2018). For example- L'Oreal provides individualized recommendations for hair care products using the data from its smart hairbrush (Bishop, 2019). Therefore, personalization enhances the relevance and frees consumers from processing irrelevant information, thus saving time and effort (Yoon et al., 2013).

The third form of value creation stems from 'Ambient Embeddedness', which means integrating the product, process and communication in the everyday life of consumers (Reinartz et al., 2019a). This adds value in the form of relevance, experience, and convenience. For example, Amazon's Alexa is a product that blends into shopping activities and daily utility in the form of an intelligent voice-based assistant (Elvy, 2018). It adds to the convenience of shopping as it is voice-based, and users can shop whenever, wherever they are, with the help of a digital assistant. In addition, this assistant is intelligent enough to know and remember users' details and tastes to make the relevant information available. Location-based notification is an example of geotargeting, which is yet another form of ambient embeddedness (Luo et al., 2013). The whole experience of doing things is shifted with seamless integration, and they add a different value. Experiences "provide sensory, emotional, cognitive, behavioral, and relational values" (Schmitt, 1999).

'Interactions' that has been possible with digital technologies create values beyond the exchange of the product only (Ramaswamy & Ozcan, 2018). The interaction may range from pre-purchase, purchase to post-purchase activities. For instance, "Place" is an app from IKEA where they allow how the specific furniture item would look in the homes of the users, providing a form of interaction with product and services (Pardes, 2017). Interaction creates values through convenience, relevance, and experience. In addition to 'Interaction', 'Transparency' also creates value. Users can access and retrieve information about the products and services they consume through online product descriptions and reviews (Verhoef et al., 2017). Furthermore, users can analyze data for insightful information. For instance, users can monitor and optimize their brushing habits through Colgate's smart toothbrush's coaching (Reinartz et al., 2019b).

Overall, a business's digital transformation opens opportunities to create values in creative ways that were not possible before without the new technologies and right adoption. With new technologies, a wider communication network- an increasing amount of data and content can be created and exchanged, which facilitates the creation of an array of digital services. These services meet the unmet consumer needs and add convenience, relevance, and transparency to the services delivered.

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Transforming the Value Creation Process

Business is getting more competitive with a limited customer pool and increasing new entrants as service providers. In the race of delivering services faster, better, easier and cheaper the way services were understood is changing (Taylor et al., 2020). With Uber, transportation has been redefined, and now anyone can be part of the transportation game (Jordan, 2017). People don't need to go and find the transportation service provider, but the service provider comes to the customer. Both consumers and providers are moving away from the traditional product-centric model to a service-oriented one called digital servitization (Gebauer et al., 2021). Digital technologies are expected to transform companies from product providers to solution providers (Hasselblatt et al., 2018). Servitization contributes to differentiation and enriches the revenue generation by closer collaboration with customers (Scherer et al., 2016).

This change in value creation can be understood in terms of four relational components- complementary digitization capabilities, relation specific digital assets, digitally enabled knowledge sharing and partnership governance (Kamalaldin et al., 2020). Businesses form partnerships with the firms that have complementary digital capabilities to create new values that were impossible before. Finding the complementing capabilities are one of the initial motives of partnerships (Dyer et al., 2018). Since digital transformation requires specialized knowledge, skills and competencies (Ardolino et al., 2017), co-creating values by complementing each other are one way of transforming the value creation process observed with increasing digitalization. The second type of transformation in value creation emerges from investment with specific digital assets. These assets can be shared assets, shared standards for compatibility or even infrastructure (Lerch & Gotsch, 2015). The third form of transformation in value creation roots in excessive knowledge sharing possibilities in the digital-savvy world due to ease in communication and interaction (Luz Martín-Peña et al., 2018). Digital data sharing is easier, leading to transparency, informed decision making and innovation through the exchange of knowledge (Barrett et al., 2015). Governance of partnership plays a pivotal role in value generation from partnerships. It can be the third party governed, self-enforced, informal like trust-based (Gulati, 1995) or formal like contracts (Reim et al., 2018).

This transformation in the value creation process has shifted the business paradigm itself. AirBnB has redefined the travelling and staying experience where value sprouts from a partnership between homes that are willing to share space and the platform that facilitates renting (Dogru et al., 2020). Technological revolutions are not only redefining the products and services only but challenging the fundamental essence of the business itself. With increased capacity in information technology, automation, and intelligent computing, businesses are playing their value creation game completely differently. Such digital revolutions mean better and more efficient business and positively impact sustainability.

The Thorns of Digital Transformation

Operational excellence and positive financial performance are the desired outcomes of firms' digital transformation. While there are exemplary achievements out there, there are some fearsome examples too. Privacy issues and distrust even on the government launched apps in France and Australia signal the downside of digital transformation (Rowe, 2020). Personalization is realized as the result of huge data collection and analysis. While the value of individualization is obvious, the risks of a privacy breach and data misuse (Martin & Murphy, 2017) cannot be ignored as well (Elvy, 2018). Besides privacy, the fear stems from piracy as well. Online security threats and ransomware has pressured industries and people

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to be highly alert and spend on cybersecurity. These are some pain points of digital users in the digital world. But above this, there are problems at the end of people who are not ready to use the technology due to lack of resources or skills. The speedy digital transformation will leave them behind and increase the digital divide causing the larger social issues stemming from the gap between these two groups.

The social issues are rooted in resistance as well. The beauty of automation brings the fear of job security. The employee resistance can halt the firm when it is expected to expedite. Here, the role of leadership gets crucial to motivate and align resources to handle the situation gracefully. On the one hand, managing the resources is difficult. On the other hand, the scarcity of skilled resources to digitalize the business and run it under the changed environment is even more difficult. Leadership should be very careful in planning the technology renewal to ensure its successful operation. Installing a new system is merely one step of digitalization. Being able to operate it as expected needs meticulous planning and execution. In this constantly updating world, up to date knowledge of the technological and business landscape is not sufficient for leaders. They should have a knack to smell the possible leap in the technological world and the wave of change it brings in the socio-economic arena. Leaders should be able to navigate their investments and efforts on the right technologies amid the sea of evolving new products and technologies.

PERFORMANCE MANAGEMENT IN DIGITAL TRANSFORMATION

Many firms are rushing to transform themselves to survive the digital wave and harvest performance gains. Though the digital transformation holds a lot of promises, executing it the right way is not easy. A lot of digital transformation projects-fail (Elter et al., 2021). The negative impacts are as strong as their positive potentials if not done right. Besides the lack of resources, knowledge and appropriate leadership, sometimes higher expectations and Overspeed in transformation can toll the firm's performance. For example- collecting too much data in such a way that customers begin to get alarmed and drift away, automating at a faster pace such a way that employees feel insecure (Goethals & Ziegelmayer, 2022), heavily playing with technologies that regulators are concerned about (Halford, 2017). Therefore, managing digital transformation and its performance expectations is crucial to set the expectations that are not too low or not too high, execute actions to achieve them, and monitor and control them for smooth continuity.

Planning the Performance

Firm performance is mostly associated with the monetary benefits that firm makes. Hence, financial planning and budgeting are meticulously developed to plan the firms' operations. At a high level, the transforming firms plan the revenue from two streams- online and offline. Here online firm performance can be planned by working out expected revenue generation, average transaction size, hence required a number of transactions, required number of customers, required number of customer conversions and so on (Ghobakhloo & Iranmanesh, 2021). This planning may further include the digital capacity planning and corresponding operational capacity of the business. The digital order taking may be easier, but can those orders be delivered, keeping the service level higher? Customers in the digital era are much more powerful than before, and dissatisfied customers can backfire businesses more seriously (Wasan, 2018). So, knowing the real capacity, then planning the marketing effort, planning the service level in

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the digital world looks similar, but the methods are digital. For example, customer lead generation in a digital world can be done online by analyzing the search keywords, hashtags, digital behaviors, etc. (Lipiäinen, 2015). Then reaching the customers through online advertisement is more precise as marketers can target customers by configuring the advertisements to broadcast to a group of customers with desired attributes. For example, Facebook allows the selection of the gender, region, and age group of the target group (Baglione et al., 2017). Marketers can even more broadcast advertisements to those with certain customer behavior that crosses the boundary of geographical attributes.

Besides the performance planning on the financial part, i.e., revenue generation and hence customer target and conversion, the performance planning could be on keeping the service level high and developing the goodwill. Planning the convenience, relevance, safety, and utility is highly important (Reinartz et al., 2019a). Simplifying the customer journey and having meaningful value delivery is a challenge of digital business. Delivering service with fewer and less complicated interactions, partnering with payment channels and delivery channels, and integrating with other value chains is crucial for performance planning (Sun & Zhang, 2021).

Achieving the Performance

Just the best plan doesn't ensure the best result if the execution of the plan doesn't fall in the right hands. Here comes the role of leadership to acquire and keep up the right capacity and resources. Acquiring the right capacity and resources is subject to the size and resources available in the business. Though material resources can be bought and installed, acquiring knowledge-based resources like skills and workforce is not straightforward (Colapinto, 2010). Hiring experts and trainers and cultivating the new knowledge in firm culture requires a careful series of communication followed by supplementing knowledge in the form of training and support. Transforming people and culture is very important (Halpern et al., 2021) to achieve the performance goals in the process of firms' digital transformation.

With the new tools and technologies, fundamental ways of creating and delivering values to customers may change (Arthur, 2009). Management should ensure that the new goals are achieved with the new tools and techniques. In order to do that, making people ready is of high importance parallel to making the new environment ready (Halpern et al., 2021). Making the environment ready may involve the installation of new tools and technologies. For example, installing new robots in a warehouse for automatic movement of crates, installing smart cameras to detect if stockpile is at a critical level in the shelf, new visualization dashboard to see the possible fraud transaction, etc. Making people ready may involve training the employees with new software and hardware. This may involve fundamental differences like managing orders coming online to get them delivered instead of standing on the shopfloor to communicate and serve customers in real-time or just some tweaks in existing scenarios like machine-assisted fraud detection instead of a manual signature check. Furthermore, making people ready can prepare customers as well for the change in service creation and delivery (Salman & Abd.aziz, 2015). Businesses may have a transition phase where customers with the old knowledge of service consumptions are entertained but motivated to move to a new paradigm, or businesses may go omnichannel with online and offline service support.

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Assessing the Performance

Businesses will have an impact on their performance with their digital journey. Those impacts are the indicators of where the business is heading. It signals whether to continue to pursue the digital projects as they are, speed up, slow down, stop the projects, modify some actions or similar other indicators (March & Sutton, 1997). Such impacts are observed, recorded, and analyzed by the business. Various metrics are developed to measure the impacts of the digital transformation, which may range from very simple measures like firm revenue to very complex measures (Singh & Harmon, 2003). Broadly those measures can be categorized as financial and non-financial.

Financial measures are critical for a business to gauge if any effort can be continued profitably or not (Oral & Yolalan, 1990). Any efforts that have a negative impact on profitability may be revisited. Financial measures are especially important to managers to control the business operation and take the next business decision. The financial measures can be as simple as gross revenue, net profit, or some ratios like efficiency ratios, leverage ratios, or rates like rate of return, etc (Ball et al., 2015). Besides the financial, non-financial efforts are also very crucial to efficiently run the operation and keep the business directed towards the planned goal. Non-financial measures range widely from measurements at the customer end to product/service manufacturing end. One of the most obvious metrics is the speed of service creation and delivery. Intelligent bots, RPA and software programming saves a lot of time. Besides the real time saving, customers save time by ordering and interacting online (Yoon et al., 2013). Though 'ease' is a fairly subjective term, it is another non-financial metric. Services and products are more relevant, timely and convenient with digitalization (Reinartz et al., 2019b). Sometimes, some customers or employees may feel that the services or service creation has become difficult as the new technologies are difficult to learn and adopt. Firms should be careful to choose and adopt the technologies to avoid resistance. The extremes of non-financial measurement can be related to social and environmental performance factors like reducing paper waste, increasing digital waste, employment level, etc.

SUSTAINABILITY

It has been found in previous studies that digital business strategies have a favorable impact on a firm's financial success and sustainability. In this case, the sustainability strategy serves as a moderator in the relationship between digital business strategy and financial performance (Ukko et al., 2019). In a similar vein, Pappas et al. (2018) present the Digital Transformation and Sustainability Model (DTSM), which depicts how business analytics and big data are becoming the drivers of digital transformation and sustainable societies, respectively. This model says that the analysis of society's actors should be done in a way that allows for the creation of new knowledge, innovation, and value, rather than being done alone, as this model suggests.

Digital transformation is both a catalyst for and a precursor to long-term sustainability. Organizations that want to make it through the digital revolution must improve their digital capabilities while balancing their economic, environmental, and social implications. According to Hsu et al. (2018), from an organizational viewpoint, organizations are being driven to boost the adoption of new applications or services in order to maintain their competitive edge as a result of technological revolution. This transition also incorporates sustainability issues as essential elements in the strategic planning of the organizations. This digitalization process includes not just the producer, but also the whole logistic

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chain that supports the producer. Kayikci (2018) examined this phenomenon, emphasizing the role of the supply chain in the digital age. He claims that digitizing the supply chain increases transparency, decentralization, and connectivity. It also enables for real-time monitoring, which has a positive effect on the industry's sustainability efforts.

In order to embrace sustainability and digital transformations at the firm level, present liabilities must be identified, as well as possible firm-specific benefits. It is necessary to make structural changes at the organizational level, as well as at the level of the new function that a firm must play within a business eco-system, in order to incorporate sustainability and digitalization into the company's strategy. In the same way, the viewpoint of the user or consumer is also required. To build interactive systems with customers, firms committed to sustainability might produce services and goods that are technologically oriented. Authors like Gadenne et al. (2012) assert that a better performance management can lead to the sustainability. As discussed in the previous section, digital transformation of products and services help a firm to reduce the cost, increase the revenue, acquire new market and customers and it provides an opportunity to bring innovation to the firm. To become sustainable in the longer run a firm must be profit making entity and its resources should be well managed to get the maximum throughput.

CONCLUSION

Digital Transformation, if mismanaged, may be a burden and threaten the firm's long-term existence. On the contrary, if it is executed well, it can open new avenues of revenues and ensure sustainability. The sustainability of a firm is about its longevity, which means its continued profitability to ensure that it can operate indefinitely. This longevity roots in ensuring a better integration with suppliers, customers, and other stakeholders to keep a favorable environment for the firm. The digital integration facilitates transparency, and hence trust. Trust is foundation for long lasting relationship. Optimality is quintessential for sustainability. Companies that invest in sustainability typically have enhanced resiliency, operational performance, and commercial success. Success comes from automating the processes, data driven decision makings, faster response rates and so on.

It is obvious that digitalization brings benefits mentioned above and beyond that. But the greed to harvest those advantages more and faster can be an accident for the companies. More data translates to more insights and hence better decisions and more opportunities. This is true only if the firm has capacity to handle, analyze and use the data. If not, it is also the source of unnecessary cost of collecting and holding data. Even more, firms can face legal penalties and public rebuke if they don't adhere with different regulatory policies, public rationale, and ethics. Today's digital transformations must be purpose-driven and deliver for all stakeholders in order for a firm to be profitable. While the businesses must tune their digital activities to keep their stakeholders satisfied for prolonged existence, they should plan and protect their business from unwanted external digital threats slithering in form of malwares, data sniffing and stealing activities as well as the harsh public blows of digital attacks like ransomware. These attacks slash the monetary assets. Worse than that is the loss of goodwill and public confidence on the firm. Loosing stakeholder confidence is disastrous to firms' long-term sustainability.

Sustainability cannot be imagined without profitability. Profitability is ensured with increased revenues and decreased expenses. The longevity of this profitability roots to firms' capability to make it relevant in ever changing environment and operate in that environment. Prolonged operation in an environment is possible only by ensuring the safety and benefit of the all the stakeholders. Firms' digitalization ensures

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enhanced productivity, profitability, and efficiency. Furthermore, with a proper performance management of digital transformation, firms can uncover its path to sustainability. Moreover, with the new forms of value creations- the relevance, convenience and transparency has levelled up, which contributes to deeper interaction, integration, and trust of the firm with its different stakeholders. Digital transformation can enable the firms to do effective customer management wherein they can focus on retaining existing customers and acquiring new customers while using the insights generated from the collected customers and sales data. Companies can use these stored data for targeted marketing, cross-sale, and up-sale campaigns. Stored customer and sales data have yet another advantage to knowing consumer behavior and purchasing behavior, which companies can use to predict their future course of action. Thus, all these activities will bring competitive advantages to the firms, and ultimately it will lead to sustainability.

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Chapter 2
The Rise of Digital Transformation Within Businesses in the Pandemic

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ABSTRACT

Because of the threat it poses to human health around the world, the COVID-19 pandemic has had devastating effects on the economies of all countries. Businesses had to change their business models, working conditions, marketing communication, technology usage, strategy development, and supply chain relationships in order to continue operations that had come to a halt. In order to realize this change in the best way, businesses have attempted to integrate digital tools into their business processes. As a result, the business world experienced a rapid digital transformation. Based on those, the purpose of this chapter is to investigate the impact of the rise of digital transformation on businesses during COVID-19. The existing literature and reports were reviewed for this purpose. It is thus discussed how businesses experienced digital transformation during COVID-19.

INTRODUCTION

In addition to technological developments, globalization, changing customer expectations, and unusual events such as COVID-19 are now accelerating the transformation of the information society and making the integration of digital tools into business processes more commonly (Gabryelczyk, 2020). Thus, digital transformation becomes mandatory for companies by expanding its scope (Fletcher & Griffiths, 2020). In its most basic form, the process that starts and continues with digitization takes its final form in the third stage with digital transformation (Verhoef et al., 2021). Digital transformation builds on

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the previous two stages and uses data and information technologies in the business world to make data-based decisions, including the creation of systems and maintaining their working (Verhoef et al., 2021).

Digital transformation is worth researching as it integrates technology in all processes of the businesses by bringing innovation to product/service (Shankar et al., 2021; Jiang & Wen, 2020), business models (Kraft et al., 2021), customer experiences (Jiang & Wen, 2020), skills (e.g., data management, analytics, digital literacy; Young & Rogers, 2019). Those innovations are essential tools for increasing revenue (Singh et al., 2021), making a great contribution to the performance (Singh et al., 2021), as well sustaining competitive advantage (Singh et al., 2021). In other words, to maintain their existence, firms have to keep up with digital transformation (Moşteanu & Fathi, 2020).

In addition to these several different benefits of this phenomenon, the importance of digital transformation has ascended during COVID-19 (Gabryelczyk, 2020). In the COVID-19 pandemic, businesses had to perform digital transformation quickly with the support of all their stakeholders, even if they had no previous preparation and experience in digitalization (Gabryelczyk, 2020). Although in the first stages of digitalization, there are preliminary steps of digital transformation such as technology-oriented structuring of business processes, transforming businesses into more agile and organic structures, adopting standardization and automation, and reshaping their strategies and culture digitization has been faster during the pandemic and this process is getting accelerated to prevent the economic effects of the pandemic (Soto-Acosta, 2020). The results of the research conducted by McKinsey & Company (2020) and IDC (2020) show that the digital transformation activities carried out during the COVID-19 period peaked. Besides, according to Twilio's (2020) report, 79% of respondents thought that the budget for digital transformation increased during COVID-19. Besides, it is estimated that direct investments in digital transformation can reach a total of USD 6.8 trillion between 2020 and 2023 (IDC, 2020). Therefore, digital transformation is also becoming more important than ever before (Elgazzar et al., 2022). Integrating technology in all processes of the business is not an elective alternative especially during these unusual times (Elgazzar et al., 2022). COVID-19 has shown that organizations should give more importance to digital transformation when compared to pre-COVID-19 times to meet at least the basic needs of people such as health, education, and communication to continue their life span, digital transformation is obligatory for companies (Fletcher & Griffiths, 2020). To overcome the economic effect of COVID-19, it is necessary to understand how it leads to change in the business world (Klein & Todesco, 2021). Furthermore, it should also clarify how COVID-19 triggers digital transformation (Priyono et al., 2020). However, as far as we know, there is no study that fully addresses the issues related to the effects of it on the business world. Sectoral and/or international reports examined the relationship between digital transformation and the pandemic and investigated that issue in detail. However, academic research should also examine the related issue in this regard by combining all these efforts to find highlighted topics to explain the effect of the pandemic on digital transformation. By following this need, this study aims to clarify the rising importance of digital transformation through the pandemic by considering both sectoral investigations and academic research conducted to highlight the related issue from several different perspectives.

During COVID-19, businesses have experienced the transformation of business models (e.g., Nesheva-Kiosseva, 2021), the transformation of working conditions (e.g., Dwivedi et al., 2020), the transformation of marketing communication (e.g., Shankar et al., 2021), the transformation of technology usage in businesses (e.g., Sharifi et al., 2021), the transformation of strategy development (e.g., Perri et al., 2021), the transformation of the supply chain (e.g., Sarkis, 2020), in a more digitized way. At the same time,

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the effect of digital transformation both in the public (Gabryelczyk, 2020) and private sector (Reyes, 2021) are felt more during COVID-19. Thus, their corporate social responsibility

(CSR) activities (Liu & Jung, 2021), strategy development processes (Perri et al., 2021), as well as human resource management procedures (Hisa et al., 2022), were also affected. Considering all of these, businesses are exposed to the transformation of the organizational culture via digital transformation during COVID-19 (Hisa et al., 2022). Through a detailed examination of all related sources, this study examines the rising importance of digital transformation during COVID-19 and provide prominent topics showing the rising importance of digital transformation through the pandemic effect, such as the transformation of business models, the transformation of working conditions, the transformation of marketing communication, the transformation of technology usage in businesses, the transformation of strategy development, and the transformation of the supply chain in a more digitized way. By doing this, this study combines several different focuses of researchers and provides a source for management science and the business world. Herewith, both business research and practices are contributed by providing a source covering all relevant steps taken for understanding pandemic effects on digital transformation.

BACKGROUND

The Rise of Digital Transformation

The digital transformation which began in 2000 (Patel & McCarthy, 2000), took place in three stages (Verhoef et al., 2021): digitization, digitalization, and digital transformation. Most of the literature acknowledges that digitization and digitalization as the first phases are needed to obtain the phase of digital transformation (Parviainen et al., 2017). *Digitization* is the codifying from analog information to a digital format (e.g., into zeros and ones) such that computers might stock process, and send such information (Loebbecke & Picot, 2015). Based on this, digitization implies the process of transforming the company into digital and is broadly defined as the use of digital technologies for providing value-creating opportunities in businesses (Gray & Rumpe, 2015). Examples include using digital forms in ordering processes, using digital surveys, or using digital apps for internal financial statements.

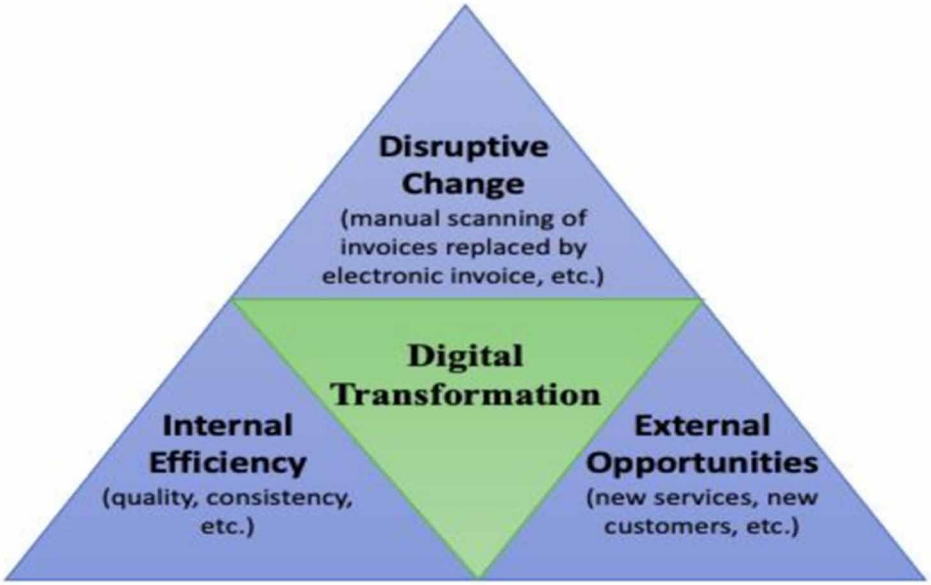
After digitization, the process continues with digitalization (Verhoef et al., 2021). Digitalization implies the change of strategies, business models, processes, decision support infrastructure, forms of cooperation, products, and services by using information technologies for creating customer value. Thanks to digitalization, new business types emerged, such as e-commerce. The use of new online or mobile communication channels that alter typical firm-customer relationships exemplifies this issue (Ramaswamy & Ozcan, 2016).

Digitalization affects organizations in three ways: internal efficiency, external opportunities, disruptive change (Parviainen et al., 2017). While internal efficiency refers to the way of working and internal processes developed through digital tools, external opportunities refer to new business opportunities in the current business area, and a complete change in business models (Parviainen, et al., 2017). Lastly, disruptive change implies huge changes in the operating environment of the organization by digitalization (Parviainen, et al., 2017). These effects create digital transformation as a third stage (see Figure 1), and it is described as company-wide change that leads to the development of new business models (Pagani & Pardo, 2017). The digital transformation that is the most pervasive phase, may accomplish competitive

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advantage in business models (Verhoef et al., 2021). A new business model or a new business logic can be an example of digital transformation.

Figure 1. Digitalization impact
Source: Adapted from Parviainen et al. (2017)



Related Definitions and Concepts on Digital Transformation

With the increase of digitalization technologies, social networks and big data have been widely used by all companies from several different sectors. For example, Netflix, Amazon, and Spotify can be demonstrated as three of the most common examples of digital transformation. In terms of real-world instances of digital transformation, the multi-colored plastic RFID wristbands (MagicBands) available to visitors to the Disney World site that interface with the company's guest management system MyMagic+ are a step forward for digital transformation. Another example is the digital transformation of businesses like Uber and Airbnb by developing solutions that are compatible with the sharing economy. Finally, BMW is undergoing a digital transition with the DriveNow car-sharing service. Users of DriveNow can rent automobiles anywhere and whenever they need them. When billing vehicles that are picked up and dropped off anywhere, the minute consumption is used as a reference.

Despite the rise of those technology tools in business practices, there is no consensus in the current literature on what 'digital transformation' means and which dimensions it includes (Vial, 2019). Table 1 summarizes the definitions of digital transformation based on a review of the related literature. When the definitions in the extant literature are examined, it is seen that the definitions of digital transformation have two focuses in the most general sense: business perspective and social perspective (e.g., Ebert & Duarte, 2018; Fitzgerald et al., 2013).

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Table 1. Definition of digital transformation, and the tools

Definition of digital transformation	Tools (Cay et al., 2019)
Digital transformation is defined as an effective shift in technology utilized to improve a company's performance (Schallmo et al., 2020).	Big Data Applications, Artificial Intelligence, Internet of Things, Cloud Computing, Robotics, Additive Manufacturing, Augmented Reality, Virtual Reality, Social Network, E-Commerce
Digital transformation is about adopting disruptive technologies to increase productivity, value creation, and social well-being here (Ebert & Duarte, 2018).	
Digital transformation is defined as the use of new digital technologies to improve marketing activities, streamline workflows, or develop new business models (Paavola et al., 2017).	
Digital transformation is expressed as new business procedures and practices to help the company compete more successfully in an increasingly digital environment (Kane et al., 2017).	
Digital transformation is not a simple software upgrade or supply chain improvement project within the organization, it is a planned digital shock at how a functioning system can be improved (Andriole, 2017).	
Digital transformation as a business perspective encompasses digital innovation which focuses on the digitization of processes and existing physical products (Berghaus & Back, 2016).	
For any digital innovation to be a digital transformation, the company must radically improve its performance through digital technologies (Bekkhus, 2016).	
The application of new digital technologies (social media, mobile, analytics, or embedded devices) to enable major business benefits (such as enhancing customer experience, streamlining operations, or creating new business models) is referred to as digital transformation (Fitzgerald et al., 2013).	
Digital transformation is expressed as an evolutionary process that uses digital capabilities and technologies at every stage to create value in an organization (Lankshear & Knobel, 2008).	
Digital transformation is the fundamental change that causes the use of digital technology in every aspect of human life according to Sawyer and Crowston (2004).	

Digital transformation, as a business perspective, entails a complete overhaul of company models, working conditions, marketing communication, business strategy, and supply chain (Gabryelczyk, 2020). It is a holistic shift that affects company models, customer interactions, job descriptions, staff capabilities, and even corporate culture as well as enterprise business procedures (e.g., Gabryelczyk, 2020).

In terms of social perspective of digital transformation, individuals benefit from digital technologies in every aspect of their lives (Jiang & Stylos, 2021). of digitalization, mobile phones are no longer just communication tools; they became devices such as cameras, clocks, calendars, stopwatches, compasses, video players, etc (Jiang & Stylos, 2021). Thus, these devices do not just serve as a phone but do also have various features. On the other hand, platforms such as Facebook, Twitter, and Wikipedia have made gathering and sharing information online possible. Books, magazines, newspapers, and documents have been digitized, and reaching them has become much easier. By following all those innovations, digital technologies are expressed as the last long wave of the socio-economic evolution of humanity. Through these developments, digital transformation leads to social transformations as well as economic transformations (Ebert & Duarte, 2018).

As can be understood from those definitions, digital transformation also refers to a social process that creates comprehensive changes in people's lives. Besides, people can access information easily whenever they want to get. Moreover, they can share information via their social media accounts quickly. On the other hand, they can solve their problems via electronic documents without using papers. Those and

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more than those, all transformations about digital make people's lives easier and change their habits by digitizing them.

Another critical issue noticed from the definitions is that any business transformation can be termed digital transformation if it is carried out in the digital domain using digital technology tools such as big data applications, artificial intelligence, the internet of things, etc. (Please see Table 1, Cay et al., 2019). Digital technology tools, allows digital products and services to proliferate faster, markets to become clearer faster, ideas to circulate faster, and organizations to find and develop their consumer base more easily (Bodrov et al., 2019). For instance, artificial intelligence can assist marketing activities by classifying what consumers search through Google for. Thus, using digital technology tools efficiently ensures the success of transformation and an understanding that can how to enter the digital market by companies (Bodrov et al., 2019).

To sum up, based on the definitions above, the term digital transformation represents a process that aims to improve and disrupt social, cultural, and business environments by triggering significant changes in the characteristics of an asset through a combination of information, computing, communication, and connectivity technologies (Vial, 2019).

DIGITAL TRANSFORMATION IN COVID-19

The Rise of COVID-19

Today, the whole world is faced with one of the biggest pandemics of the last century (Dwivedi et al 2020), COVID-19. The COVID-19 pandemic, the first case of which was seen at the end of 2019, crossed the borders of countries and was declared a pandemic by the World Health Organization (WHO) on March 11, 2020. According to WHO (2021), there have been 418.650.474 confirmed cases of COVID-19, including 5.856.224 deaths around the world, as of February 18, 2022. That's why 2020 and 2021 have been the years of pandemics for the entire world, representing an uncertain process.

Creating an unpredictable environment for the whole world, COVID-19 has caused great stress for humanity. With the spread of COVID-19, the common symptoms of which are dry cough, fever, fatigue, and difficulty breathing, global efforts have been made to halt the spread of it and, eventually, eliminate the pandemic (Marbouh et al., 2020). As indicated in Table 2, the common symptoms of COVID-19 are dry cough, fever, tiredness, breathing difficulty. With the spread of COVID-19, measures have been taken around the world to stop the spread of COVID-19 and ultimately eliminate the pandemic (Li, 2021; Marbouh et al., 2020). Although it varies depending on the number of cases, in general, countries wanted to control and eliminate COVID-19 by taking similar measures such as wearing masks, washing hands, etc. Social isolation is at the forefront of the measures taken during the pandemic period. Since there was neither medicine nor vaccine to prevent the spread of COVID-19 disease, these measures were given significant importance at the beginning of the pandemic (Marbouh et al., 2020). With the availability of the vaccine and its widespread use worldwide, vaccination has been also among the measures. Those measures necessitate an isolated life at home as much as possible to prevent people from collectively being together. To achieve this, new practices such as curfews, reducing the number of people in the same environment, and social distance rules are being implemented (Marbouh et al., 2020).

While these measures profoundly affect people's daily lives, they also mean that factories, markets, and businesses will be closed temporarily, most public transportation will be suspended and construc-

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tion work will be halted (Li, 2021; Marbouh et al., 2020). In addition to individual measures, states have also made efforts to reduce the spread of COVID-19 and mitigate its effects by following up on patients, contacts, and testing those with symptoms. Besides, postponing social events and closing entertainment venues can be seen as other mitigation efforts (Marbouh et al., 2020). The global impact of COVID-19 brings city/country lockdowns, restricts human movements, suspends business activities, and slows down global markets. A lot of effort has been put into mitigation efforts as well such as anti-pandemic testing centers, temporary hospitals/clinics (Please see Table 2).

However, while preventive measures and mitigation efforts were critical in halting the COVID-19 pandemic, they resulted in significant short-term economic losses (Deb et al., 2021). The most obvious economic effects of these measures have been the downsizing of companies, the closing of companies, and the dismissal of employees, as seen in Table 2. Besides, some research has shown that the 30-day period following the preventive measures and mitigation efforts is equivalent to a loss of about 10% in industrial production (Deb et al., 2021). Other economic activity indicators show that cost-cutting measures have had a negative impact on energy consumption, maritime trade, retail, and transit mobility (Deb et al., 2021). Despite this, the loosening of containment measures has resulted in a promising rebound in economic activity (7% increase in industrial production).

Table 2. COVID-19 symptoms, preventive measures, global impacts, mitigation efforts, and economic impact

Symptoms	Preventive Measures	Global Impact	Mitigation Efforts	Economic Impact
Dry cough	Wearing mask	Closing of borders in city/ country	Contract tracing	Short-term economic losses
Fever	Washing hands	Suspending business activities	National disinfection program	Downsizing of companies
Shortness of breath	Social distancing	Slowing down global markets	Anti-pandemic testing centers	Closing of companies
Tiredness	Avoiding touching face, mouth, and nose	Restricted movement of people	Temporary hospitals/ clinics	Dismissal of employees
Fatigue	Delaying of trips			
Diarrhea	Quarantine			
Vomiting	Using alcoholic hand sanitizers			
Muscular pain	Vaccination			
Conjunctivitis				

Source: Adapted from Deb et al., (2021*); Li (2021); Marbouh et al. (2020); WHO (2020)*

The Transformation of Business World

Extant studies (e.g., Gabryelczyk, 2020) and international reports (e.g., ICC, 2020; IDC, 2020; The Manufacturer, 2020; Twilio, 2020) have shown that the requirement of digital transformation is rising within businesses because of COVID-19. Most industries are accelerating the transformation to digital. It is also seen that the rise of digital transformation can be observed in several different sectors. Ac-

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cording to Twilio's (2020) report, 78% of technology companies, 77% of energy companies, 74% of healthcare, %71 of construction, 70% of retail & e-commerce, 65% of manufacturing & automotive, 61% of professional & technical services, 60% of financial services speed up digital transformation in their organization. As stated, tech companies are naturally the leader of digital transformation.

Research conducted by McKinsey & Company (2020) also examined the pace of digitization in customer communication, product, and service globally and some continents such as North America, Asia-Pacific, Europa. Research results show that products and/or services and consumers are dramatically turning to digital (Please see Table 3). Table 3 shows that the digitization of customer interaction and the digitization of products/services have increased regularly since 2017. But in 2020, there has been a sharp increase with COVID-19.

As Table 3 shows, digitalization of products and/or services and digitalization of customer interaction occurred mostly in North America. On the other hand, digitalization of customer interaction was least in Asia-Pacific (53%) as well as digitalization of products and/or services least in Europe (%50). Before COVID-19, the digitization of the products/services was greater than the digitization of the customer interaction in all categories until 2019. When it comes to North America, in pre-COVID-19, the digitization of the products/services was also higher than the digitization of the customer interaction, except for 2019 (the same in 2019). The digitization of the customer interaction then was higher as of 2020. The digitization of the customer interaction in all categories, except Asia-Pacific, was higher than the digitization of the products/services as of 2020. These data show that COVID-19 has more increased the digitization of customer interaction.

Transformations taking place in those several different sectors and countries are discussed in detail in the following sections.

Table 3. Digitalization of products/services and customer interaction by several years (%)

Years	Global		Asia-Pacific		Europe		North America	
	Products/ Services	Customer Interaction	Products/ Services	Customer Interaction	Products/ Services	Customer Interaction	Products/ Services	Customer Interaction
2017	29	20	31	22	26	18	33	25
2018	28	20	26	19	25	19	34	25
2019	35	36	33	32	34	32	41	41
2020	55	58	54	53	50	55	60	65

Source: Adapted from McKinsey & Company (2020)

The Transformation of Business Models

The business world, which is already in a transformation, has experienced a difficult time coping with the COVID-19 pandemic (Gabryelczyk, 2020). It was inevitable that COVID-19 would turn into stress on businesses (Gabryelczyk, 2020). Measures such as wearing masks, social distances, and lockdowns have forced trade relations to change since the traditional face-to-face trade methods have been difficult to implement (Alalwan et al., 2021). This situation brings efforts to adapt to new processes (Subramaniam et al., 2021). For example, during the COVID-19 pandemic, organizations have been needed interactiv-

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ity, synchronicity, ubiquitous connectivity, and customization to interact and communicate with their customers and also employees (Alalwan et al., 2021). Thus, it can be meant that companies have been needed a new business model accelerating digital transformation due to COVID-19 (Nesheva-Kiosseva, 2021). When the reports on the transformation of business models are examined, it was observed that the transformation of business models has risen 23% (Fujitsu, 2020). Besides, improvement of business agility (50%) and greater efficiency (48%) are also rising due to digital transformation during COVID-19. These changes show that COVID-19 has had several effects on business models, and the impact of these changes on the business world. After the COVID-19 pandemic, it is unclear how the future of business models will be shaped (Choudhary, 2019; Radziwon et al., 2021). Thus, examining the effect of digital transformation is vital to make inferences about the future of the business world.

COVID-19 has led to the emergence of new business models for several different industries. For example, restaurants had to transform their business models (Choudhary, 2019) to provide services without human touchless during COVID-19 (Wen et al., 2020). In this context, cloud kitchens, which are restaurants that focus on takeaways have recently attracted the attention of investors due to the various features they contain (Choudhary, 2019). According to Allied Market Research (2020), the global cloud kitchen market was $43.1 billion in 2019, and it will reach $71.4 billion by 2027. As another industry, the airline industry has been affected profoundly from worldwide governmental lockdown restrictions during COVID-19 (Radziwon et al., 2021). For instance, AirAsia, which is a low-cost airway, has transformed its business into a travel technology company. This transformation has included openly collaborating and supporting one another in the process of creating and testing new value propositions (Radziwon, et al., 2021). AirAsia whose fleet of aircraft grounded has resisted the effect of COVID-19 via digital transformation. Moreover, hotels developed a new business model using hyper-automation solutions tools (intelligent business process management systems), and autonomous systems (Sztorc, 2022). Thus, hotels can overcome the COVID-19 crisis via only digital tools to survive (António & Rita, 2021). Some sectors and organizations, on the other hand, were already substantially digital prior to COVID-19 with key aspects of their business models already digitalized and these firms that already have digital business strategies are equipped for success in times of social distancing and quarantine (Remane et al., 2017). One prominent example is the burgeoning online entertainment business, which includes online gaming, e-sports, e-gambling, streaming services for music, movies, and TV programs, applications, and so on.

The Transformation of Working Conditions

In fact, with the birth of the internet, remote working has already gained importance, but even in information-intensive jobs, there has not been a rapid transition as in the pandemic process (Leonardi, 2020). Since the start of curfews with COVID-19, digital transformation has become a necessity in the private and public sectors in order to ensure the continuity of economic and social activities. During long quarantines, business owners have begun to explore and implement digital ways of working to maintain their firm's sustainability and profitability (Davison, 2020). In this way, remote work has become widespread and one of the most novel topics for the business world (Dwivedi et al., 2020). Many people think that permanent remote employment would become more common in the future (Statista, 2021). Based on that report, 15 to 16 percent of respondents said their company's personnel worked remotely prior to the pandemic, and by late 2020, 34 percent of respondents expected their workforce to work remotely permanently, even after the pandemic was over. 70% of respondents stated that they are currently work-

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ing remotely in March 2021. Moreover, the popularity of remote work, which has become widespread with COVID-19, is expected to continue after the pandemic (Quantum Workplace, 2021).

On the other hand, there are some issues about shifting from working at the office to working at home or other places. For instance, monitoring working hours was getting harder for the manager since remote working is blurring the boundaries between working and non-working hours (Unlu, 2021). Besides, the importance of protecting business data and ensuring security is rising for the organization. Taking measures on occupational health and safety is also getting difficult. Moreover, micro, small and medium-sized businesses, and their employees, as well as entrepreneurs and self-employed people have been mostly affected by cyberattacks, which have increased with the widespread adoption of work-from-home technologies (ICC, 2020). Therefore, the need for competencies to support this digital transformation has also increased. Through the rise of digital transformation within the business, having features such as digital literacy, technical knowledge, lifelong micro-learning, personal development, digital ethics (Savić, 2020) that can contribute to digital transformation are expected from employees. Furthermore, the increases in remote working have revealed several technological needs and made it necessary to accelerate digital transformation efforts to increase the adoption of e-digital tools (Batti, 2021). The demand for the internet (29%), the use of programs such as Slack, Asana, and Microsoft Teams (59%), the use of online meetings (61%), and the importance of data security (25%) are also risen due to remote working (DMEXCO, 2020).

The Transformation of Marketing Communication

As one of the areas in which businesses try to find solutions for crisis created by the pandemic, marketing communication has also been digitized in order to offer products or services to their customers via digital transformation (Jovevski et al., 2020). Marketing communication methods have been tried to adapt the new business environment after COVID-19 by using digital devices and the internet more (McKinsey & Company, 2020). McKinsey & Company (2020) showed that digitization of products/services was constantly increasing between 2018-2020 worldwide. Most importantly, the greatest increase was during the COVID-19 period. In terms of marketing communication, worldwide digitalization of marketing communication was expanding between 2018 and 2020. Similar to product/service digitalization, the most significant rise in the marketing communication occurred during COVID-19 (Please see Table 3).

Twilio (2020) investigated how sectors accelerated digital communications strategy in COVID-19. Based on the result of the report, 8.1% of construction, 7.2% of energy, 6.1% of retail & e-commerce, 6% of healthcare, 5.6% of manufacturing & automotive, 5.6% of financial service, 5.3% of professional & technical services, and 5.3% of technology companies accelerated their digital communications strategy (Please see Table 4). Besides, technology companies have the biggest rate of expanding their digital communication channels among industries (70%). Respectively, manufacturing & automotive (53%), professional & technical services (48%), healthcare services (46%), retail & e-commerce (45%), financial services (44%), construction (42%), and energy (39%) companies expanded their digital communication channels. In parallel with this, Ding et al., (2020) stated that companies with high level of technological ability (e.g., technology companies) can accelerate their digital transformation faster than companies with low level of technological ability (e.g., construction companies).

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Table 4. Digital transformation of some industries during COVID-19

Industries	The speed up of digital communications strategy	The expanding of digital communication channels
Energy companies	7.2%	39%
Technology companies	5.2%	70%
Healthcare services	6%	46%
Retail & e-commerce	6.1%	45%
Financial services	5.6%	44%
Construction	8.1%	42%
Manufacturing & automotive	5.6%	53%
Professional & technical services	5.3%	48%

Source: Adapted from Twilio (2020)

According to Shankar et al. (2021), marketing communication has been attempted to be more digitized using digital or electronic media such as online display advertising, search advertising, mobile communication, and word-of-mouth communication through social media during COVID-19. Marketers have attempted to respond to consumer needs through these communication tools by digitizing their services and products. In other words, given the current situation, consumers' needs have been met with personalized and digitalized services and/or products in the new normal such as digital detox programs, fitness programs, healthy diet programs, etc., (Jiang & Wen, 2020).

The Transformation of Technology Usage in Businesses

According to the World Trade Organization (2020), the COVID-19 pandemic has created a global crisis. Due to the crisis declining revenues and high levels of uncertainty, most businesses around the world have started to undergo a significant digital transformation and reorganize their business processes and operations with a focus on technology to survive the pandemic process (Dwivedi et al., 2020; Gabryelczyk, 2020). Since the COVID-19 pandemic has deeply affected humanity, it has become a necessity to make a change in technology components in order to continue both social life and economic activities (Subramaniam et al., 2021). Based on this, businesses have tried to reduce the adverse effects of the pandemic using various digital technologies such as artificial intelligence, the IoT, big data, and advanced analytics (IDG, 2020).

Artificial intelligence (AI) is recognized as a field of science and engineering (Shapiro, 1992), and defined as the creation of works with intelligence (Shapiro, 1992). That is, systems that can perform certain human behaviors and simulate the human thinking process related to a specific area of expertise can be created through AI. AI has assisted to develop some sectors such as health, education, banking, and the finance sector during the COVID-19 pandemic (Sharifi et al., 2021). For instance, some studies demonstrated that AI has been successfully investigated in the health sector (e.g., Huang et al., 2021). In the diagnosis of COVID-19 patients, AI has played a crucial role. Thanks to AI, patients have been diagnosed faster (Huang et al., 2021). In addition, the public attitude and their concerns toward COVID-19 vaccines have been examined by AI (Kumar & Sharma, 2021). AI has been also used to collect and analyze current data on COVID-19 and to study about the future of the pandemic (Kumar & Sharma, 2021).

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IoT is defined as a worldwide infrastructure that connects physical and virtual objects, enabling them to generate and share data (Greengard, 2021). Through the IoT, users have the opportunity to work together with new applications through object identification, sensor connections, and connected networks. By means of the development of wireless communication technologies (Feng et al., 2019), IoT can be used in several applications such as e-health, home automation, smart environment, smart water, smart agriculture, smart livestock, smart energy, smart cities, smart measurement, industrial control, security and emergencies, shopping, logistics. When it comes to the COVID-19 era, Abdullah and Abdullah (2021) have revealed that companies have adopted IoT increasingly across several fields such as airports, healthcare, hospitality, manufacturing, smart homes, smart offices, and retailing.

When it comes to analytics, advanced analytics is described as methods and tools used for processing and interpreting high-density data such as data mining, machine learning, and business intelligence (OECD, 2021). On the other hand, big data is described as data analyzing, classifying, transforming into a meaningful and processable form (Davenport et al., 2012). In the digital world, data flow can be provided in different ways such as security cameras, sensors, electricity meters, call center records, social media situations. Advanced analytics and big data have ensured detection of COVID-19 cases, prediction of future cases, measurement of potential preventive and therapeutic, and they also have assisted in informed decision-making (Mehta & Shukla, 2022).

The Transformation of Strategy Development

While adapting to the new normal with the pandemic, leaders are forced to re-evaluate their needs. Thus, digital transformation is no longer just a "nice" thing but an essential component of evolution for the new workforce model (Batti, 2021). Increasing operational efficiency, transforming existing business processes, and improving the customer experience are key business initiatives regarding the COVID-19 pandemic. Most managers stated that they give priority to these initiatives (IDG, 2020). As a result, the COVID-19 pandemic likely triggered organizational changes, compelled a rethinking of company strategy, and served as a catalyst for digital transformation in many areas of the economy, healthcare, and education (Gabryelczyk, 2002).

Many countries have implemented rules that regulate social life according to the new normal and closed their borders to slow the spread of the virus. These measures brought economic activities to a complete standstill (Ding et al., 2020). This has even led to the bankruptcy of well-known brands such as Hertz, JCPenney, and J. Crew. Therefore, businesses have sought solutions with specific strategies such as digital transformation by acting proactively (Gabryelczyk, 2020) to get rid of COVID-19. Besides, the redesign and enhancement of processes have been part of the new strategy for using innovative technology (Gabryelczyk, 2020).

Fabeil et al., (2020) argued that entrepreneurs employ multiple synchronous strategies to ensure continuous operation of their business during COVID-19 crises. In addition to shortening the supply chain and producing the emerging product to meet current customer's needs, these are using digitalized marketing through mobile applications and social media, such as Facebook and WhatsApp, employing collect on delivery or cash on demand transaction for the sale of goods, and receiving payment via bank transfer or e-wallet (Fabeil et al., 2020).

COVID-19 has also dramatically worsened bad health and created social effects for people who use drugs (PWUD) all over the world, as Perri et al. (2021)'s digital transformation strategy shows. Harms have increased for many PWUD communities because of the closure of harm reduction agencies dur-

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ing COVID-19. For instance, countries such as Australia have developed a national telecare strategy that instructs health care providers on how to incorporate telecare into their operations to mitigate these negative consequences (e.g., providing hands-on training with technological strategies). As the overdose crisis continues to combine with COVID-19, Perri et al. (2021) claim that the use of such a digital transformation strategy in the healthcare field has reduced drug-related harms and overdose fatalities.

As a result, digital transformation entails the use of a plan to implement several well-thought-out and justified digitalization projects (Gabryelczyk, 2002). This approach should include the redesign of business processes, not as an afterthought, but as part of planned operations, as well as the continual improvement of digital maturity.

The Transformation of the Supply Chain

Limiting and even restricting transportation between countries during the COVID-19 period has caused global economic activities to slow down. The measures put into practice to control the pandemic caused disruptions in the supply chain, a decrease in the production capacities of firms, and the stop of production in some sectors (Czifra & Molnár, 2020). For instance, Tradeshift, a global platform for supply chain management, announced that COVID-19 has damaged domestic and international trade transactions in China (56%), USA (26%) and Europe (17%) respectively (The World Economic Forum, 2020). Those situations caused panic for companies as they destroyed the usual order (McKibbin & Fernando, 2020). Hence, COVID-19 has transformed into an economic crisis at short notice. Based on those, COVID-19 has revealed how fragile the supply chain is (The World Economic Forum, 2020).

In general, the crisis causes a shortening of the supply chain (Fabeil et al., 2020). COVID-19, which has brought long-term ignorance, also has led to several issues in the supply chain. The most serious issue associated with supply chain disruptions is the halt of production or the closure of companies in various industries. For example, supply problems in parts from China have led Korean automaker Hyundai to halt production at all of its Korean units (Baldvin & Tomiura, 2020). Nissan has also shuttered its Japanese manufacturing operations (Baldvin & Tomiura, 2020). Supply chain disruptions have become a problem that has a cascading effect on both the internal and external of the firm. In other words, supply chain disruptions have resulted in the closure of a plant, the inability of the supplier business to sell products, the inability of the customer business to supply inputs, the layoff of many people, and the difficulty of consumers to satisfy their demands (Baldvin & Tomiura, 2020). Because of the significant consequences, in such a crisis period, the efforts of enterprises to maintain stability and continuity in the supply chain increased (Sarkis, 2020). To overcome these problems, some digital transformation-related solutions have been proposed in the existing literature to improve supply chain resilience to withstand interruptions (IDC, 2020). One of them is AI, which helps the supply chain to develop resilience in its structure and network in a systematic manner (Modgil et al., 2021). Resilient supply chains recognize (risks, degree of localization, failure modes, and data trends), analyze (what-if scenarios, realistic customer demand, stress test simulation, and constraints), reconfigure (automation, network re-alignment, tracking effort, physical security threats and control), and activate (establishing operating rules, contingency management, managing demarcation).

Adoption of IoT as a tool might help modernize and reconfigure the supply chain, as well as assist in data-driven decision-making especially after COVID-19 (Aamer et al., 2021). Data availability and consistency, for example, are key concerns in the food supply chain when it comes to tracking and moni-

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toring food loss and waste (Aamer et al., 2021). IoT is a potential developing technology for bridging this gap and minimizing food loss and waste, along with the food supply chain.

Developing an advanced analytics capability in the supply chain, on the other hand, entails using advanced analytics techniques to generate critical insights from vast amounts of data (i.e., volume, variety, velocity, veracity, and value), thereby facilitating data-driven decision-making and allowing organizations to gain a competitive advantage (Yu et al., 2021). Using advanced analytics-driven hospital supply chains, for example, provides healthcare practitioners with useful and timely guidance in developing data-driven supply chain integration for improved operational flexibility, especially in response to the unprecedented disruption caused by the COVID-19 outbreak (Yu et al., 2021).

SOLUTIONS AND RECOMMENDATIONS

The COVID-19 pandemic, which was faced at the beginning of 2020, has spread in a brief time like many previous epidemics and turned into a global economic and health crisis. In this period, on the one hand, individual and public health were taken into account. On the other hand, economic life was tried to be continued. To survive, many traditional businesses have undergone a rapid transition to the digital environment during COVID-19 due to public measures such as lockdowns. Accordingly, there have been some digital transformations in the business world. Based on the aim of this book chapter, clarifying the rising importance of digital transformation through the pandemic, the present chapter is revealed by examining the transformation of business models, the transformation of working conditions, the transformation of marketing communication, the transformation of technology usage in businesses, the transformation of strategy development, and the transformation of the supply chain, through both the business reports and the extant research. As a result of those, this chapter presents insight for academia and the business world about digital transformation through the unintended effects of COVID-19.

When the digital transformations of businesses in the COVID-19 period are examined in the context of both reports (e.g., ICC, 2020; IDC, 2020; McKinsey & Company, 2020; Twilio, 2020) and academic studies (e.g., Dwivedi et al., 2020; Gabryelczyk, 2020) it is concluded that businesses face numerous challenges and must rely on digital transformation to overcome them. Primarily, business models that allow businesses to potentially increase and improve their capabilities and demand for computing resources have experienced a further digital transformation with COVID-19 (Gabryelczyk, 2020). For example, while hotels have used intelligent business process management systems (Sztorc, 2022) to digitalize, restaurants have focused on cloud kitchens (Choudhary, 2019). Thus, businesses have overcome the COVID-19 crisis via digital transformation (António & Rita, 2021). Moreover, as a result of the lengthy quarantines, businesses began to implement digital working methods in order to protect their companies' long-term viability and profitability (Davison, 2020) such as remote working. Furthermore, the COVID-19 pandemic has increased internet usage, allowing products and services to be further digitized. Thus, marketing communication has shifted heavily to digital. When it comes to technology usage in businesses, the use of technology in businesses has increased as a natural result of the digitalization of business models, working conversations, and marketing communications (Dwivedi et al., 2020; Gabryelczyk, 2020). Based on technologies such as AI, IoT, and advanced analytics, the completion of the works has become more practical and does not pose a risk to health. The digital transformation of strategy development has also become inevitable for businesses (Batti, 2021) and businesses have sought solutions with specific strategies through digital transformation by being proactive (Gabryelczyk, 2020)

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to get rid of COVID-19. Lastly, businesses experienced a serious raw material problem with COVID-19 and became unable to continue their production (McKibbin & Fernando, 2020). To make this properly, businesses have also made an intense digital transformation in their supply chains (IDC, 2020).

FUTURE RESEARCH DIRECTIONS

Research on digital transformation in business has recently received attention as a result of COVID-19, and this work is also a reflection of pandemic-related changes in the business world. Although this review study has limitations such as not covering all organizational units within the businesses and having a narrow scope due to the fact that the literature is rather new in this area, this study can be seen as a starting point to highlight the rise of digital transformation within the businesses. The suggested paradigm for corporate transformation presented at COVID-19 may be seen as a solid basis for additional study, critique, and support. The themes identified and emphasized in the framework may also serve as a basis for business practices, since the quick speed of digital transformation is anticipated to enable rapid change in general, and notably in the domains of business and management.

When it comes to recommendations for future study, the analyzes made in this section have revealed that the Covid-19 outbreak has profound effects on businesses. Therefore, in future studies, it should be examined how sustainable, durable, flexible business models and strong crisis management systems can be created in the field of organization and management. According to this book chapter, technical infrastructure changes in several businesses have become nearly unavoidable because of the Covid-19 problem. Future studies should look at how technical infrastructure improvements can keep firms or industries up to date with digital transformation and technological innovation, as well as the demands and problems that come with it. Furthermore, future research should investigate additional environmental factors and organizational characteristics such as firm size, firm age, present performance level, customer responses, customer actions, and market-related factors.

Besides, this study focuses on the impact of digital transformation on business and specific operational units of the business. Therefore, the authors handled digital transformation as an impactful concept within businesses. However, determining the progress of digital transformation and its processes is of it have also critical importance. Although there exist some scorecards or measures for digital transformation in the related literature, we did not examine these issues based on our approach. It is suggested that future research can evaluate them according to operational units of which importance and prominence were presented in this study and in this way, future research can broaden our results by adding measuring methods for the progress of digital transformation.

When it comes to practical suggestions for digital transformation success, the first step can be for businesses to accurately assess their digital skills. In order to develop these skills and to ensure that the new ones can coexist with the old ones, the current state of the business can be thoroughly examined. In this way, determining a company's digital capabilities might aid in the development of a digital transformation strategy.

Furthermore, managers and workers are two of the most significant components of a company's digital capabilities. Thus, in order to be successful in digital transformation, firm executives must be knowledgeable about digital technologies such as cloud information systems, IoT, virtual reality, and blockchain. It is suggested that companies should provide training opportunities on the digital tools the managers need. Similarly, analyzing all employees' skills and recognizing the proper talent qualities will

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enormously boost digital transformation and strengthen new business models. Companies can establish their own academies to develop talents that play a key role in transformation. Thus, it can be ensured that employees are trained to realize their strategic transformation plans. In addition, the success of digital transformation can also be increased by hiring employees who are experts in information technologies, where the company's need arises.

CONCLUSION

The COVID-19 crisis has accelerated digital transformation and even proved impossible to avoid. During the COVID-19 process, people or institutions that use, follow, and lead the developments in technologies have experienced many changes. This change has contributed to the businesses' ability to continue their activities despite the COVID-19 measures. These changes are important for business research, as they enable businesses to survive despite the difficult conditions in this process. Within the scope of this process, this chapter aims to clarify the rising importance of digital transformation through the pandemic by utilizing several different perspectives. Based on this, this chapter presented the key issues that demonstrate the growing importance of digital transformation as a result of the pandemic: the transformation of business models, the transformation of working conditions, the transformation of marketing communication, the transformation of technology usage in businesses, the transformation of strategy development, and the transformation of the supply chain. As a result of the examination, it was determined that firms had completed the digital transition sufficiently to manage the problem.

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KEY TERMS AND DEFINITIONS

Business Model: A plan for improving or developing a business in order to run it successfully.

COVID-19: A viral infection caused by the SARS-CoV-2 virus.

Digital Transformation: A process of addressing societal and sectoral demands through the incorporation of digital technology into the corporate environment.

Digitalization: Incorporation of information technology into products and services in order to provide value to customers.

Digitization: The process of moving data and information from paper and other mediums to digital media in a computer context.

Marketing Communication: A phrase for promotional acts intended to sell products, services, or ideas.

Pandemic: The umbrella term for epidemic illnesses that spread and affect a large geographic region in more than one continent throughout the world.

Remote Work: A type of flexible working style that allows an individual to work from home or another location other than the office.

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Strategy: The course that a business must take to retain its stability and commercial success.

Supply Chain: A network formed by a corporation and its suppliers to manufacture and promote a specific product or service.

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Chapter 3
The Digital Transformation of Higher Education:
The Challenges of the COVID-19 Pandemic

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ABSTRACT

The improvements in digital technologies have changed societies in many ways. This process is commonly called "digital transformation." Many sectors have been affected by digital transformation, including higher education institutions. Also, the COVID-19 pandemic, which started in 2019 in China, triggered the use of digital technologies in everyday activities and at every level of education. This chapter primarily presents the process of digital transformation in higher education by giving examples from various countries based on recent research, providing challenges of digital transformation of higher education, and then examining the challenges and reflections of the COVID-19 pandemic on the digital transformation of higher education. Lastly, the current situation is evaluated, and suggestions are proposed.

INTRODUCTION

The dramatic enhancements in technology have been affecting various aspects of human life. Societies have to keep pace with new digital changes. How people communicate and collaborate, the structures of the institutions and the ways businesses are conducted have been changed for every sector. With the improvements and their impacts, Digital transformation (DT) has become inevitable and taken an important place for both researchers and practitioners recently, especially during the Covid-19 epidemic. DT term was firstly mentioned by Patel and McCharty (2000). Later, it was defined by various researchers. The different definitions of DT imply that DT is not only using technology. It also refers to "the changes that digital technology causes or influences in all aspects of human life" (Stolterman & Croon Forst, 2006, p. 689). The main point of DT is to focus on innovative solutions instead of focusing on the technology itself or just using traditional Information Technologies (IT). New innovative approaches

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and digital technologies serving DT include cloud computing, the internet of things (IoT), big data and data analysis tools, smart systems, and social media (Hai, Van & Thi Tuyet, 2021; Schwertner, 2017). New digital technologies have changed the ways businesses are conducted. There is plenty of research in the literature investigating the DT process in different sectors, such as the manufacturing industry (Singh, Sharma & Dhir, 2021), the automotive industry (Llopis-Albert, Rubio, Valero, 2021), finance sector (Karagiannaki, Vergados & Fouskas, 2017), and healthcare (Ricciardi et al., 2019). Commonly, digital technologies are essential to the existence of companies since the firms and companies that did not adopt digital technologies have disappeared, such as Borders, Blockbusters, and Kodak (Tolboom, 2016).

Similarly, the education field has also been affected by digital technologies. A new concept has emerged, which is "Education 4.0". It is used to express the DT of education with advanced digital technologies and their impacts on education. The DT of the educational activities and institutions does not depend only on technology. It requires technological, human, organizational, and pedagogical drivers and new teaching and learning strategies (Oliveira & Souza, 2022). The first objective of this book chapter is to define the DT in higher education. Also, examples of the educational DT projects from different countries are presented.

DT in organizations and education has been accelerated by the covid-19 epidemic (Soto-Acosta, 2020). Although the DT process in higher education started before Covid-19, it has been slower than in other domains. The Covid-19 epidemic, which is an unforeseen event affecting all the people in the world, has required and triggered innovative online solutions for educational activities and accelerated DT of higher education (Bogdandy, Tamas & Toth, 2020; Kang, 2021). The transition from the traditional classroom to online platforms dates back to the 2000s (VanSickle, 2003), and it has become mandatory with the Covid-19 epidemic for all countries in the world. There are different types of traditional and emerging technological opportunities for educational activities in higher education, such as tablets, smartphones, Smartboards, Learning Management Systems (LMS), video conferencing tools (Zoom, Skype, Microsoft Teams, Google Meet ...etc.), social media applications. However, universities have been unprepared for the fast transformation needed due to the Covid-19 epidemic. The second objective of this book chapter is to investigate how the Covid-19 epidemic has affected DT in higher education and identify the challenges.

In this context, this chapter aims to reflect an understanding of DT in higher education and guide future research by providing the current status of DT in higher education and examining the needs of the Covid-19 epidemic on DT. This chapter answers the following two research questions based on the existing studies in the literature: *(i) What is the current situation of DT in higher education, (ii) How Covid-19 epidemic affect DT in higher education?* The rest of the chapter is organized as follows. First, DT in higher education is reviewed and detailed, focusing on the definitions and technological examples from the domain. Second, the unforeseen reflections of the Covid-19 epidemic on DT in higher education are presented. Third, the challenges of DT in higher education are identified from the current research and presented. Lastly, the current state of the DT in higher education is evaluated, and suggestions are made.

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DIGITAL TRANSFORMATION IN HIGHER EDUCATION

Concepts and Definitions

The first concept that should be defined is DT. The study conducted by Vial (2019) has given various definitions of DT in the literature, mentioning different emphases such as technology, process, model, change, and adaptation. DT or digitalization, sometimes used interchangeably, can be defined as using new digital technologies in every business process (Fitzgerald et al., 2013). Also, in another definition, DT is referred to as "cultural revolution" or "transition of society" (Henriette, Feki & Boughzala, 2016). Stolterman and Croon Forst (2006, p. 689) mentioned DT as "Digital transformation can be understood as the changes that digital technology causes or influences in all aspects of human life." These definitions do not mention only the use of specific technologies. The main point of DT is to focus on innovative solutions, their changes, and impacts instead of focusing on the technology itself or just using traditional IT.

As the DT affects every part of human life, there is a need to integrate innovative digital solutions into the education domain. Early examples of DT in education depend on the use of technology to support traditional learning. Online learning, e-learning, blended learning, and distance education concepts have emerged through the use of Information and Communication Technologies (ICT) in education to conduct or support learning and teaching activities. Although online learning, e-learning, and distance education are sometimes used synonymously, there are differences in their applications. Distance education refers to changing the traditional face-to-face learning environment with the remote one allowing instructors and students to be in different places (Willis, 1993). Current distance education applications depend on the use of digital environments. E-learning refers to the learning platforms that use IT to conduct learning and teaching activities to support traditional and distance education. On the other hand, students enroll in fully virtual courses in online learning. Blended learning is used to express the combination of face-to-face learning and e-learning (Patel & Patel, 2017). These education models/methods express DT in education and its effects. Education 4.0 is also a new concept used to define the DT of education with advanced technologies. Besides these, it is essential not to forget that the DT of the educational process does not depend only on technology; it requires the use of technological, human, organizational, and pedagogical drivers and requires new teaching and learning strategies (Oliveira & Souza, 2022). Also, two critical factors affecting the digitalization of higher education are governmental support and policies and institutional strategies (Xiao, 2019). Institutional digital learning and teaching strategies should be developed and implemented as well as national ones for effective and successful digitization.

Need for Digital Transformation in Higher Education

As mentioned earlier, DT is indispensable due to the improvements in technology. Why is this transformation needed? The need for DT in higher education was changed due to the Covid-19 epidemic, which caused a compulsory transition. It is explained under two subtitles to explain the conditions due to the covid-19 epidemic: *Before the Covid-19 Epidemic* and *During the Covid-19 Epidemic*.

Before the Covid-19 Epidemic

Three major factors drive the need for DT in organizations before the Covid-19 epidemic (Verhoef et al., 2021). The first one is the adoption World Wide Web, smartphones, and emerging technologies,

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including web 2.0, cloud computing, artificial intelligence, and blockchain. The second driver is the competition between the organizations, which is changed by technology. Lastly, customer behavior has been changing due to the digital revolution (Verhoef et al., 2021). When the higher education institutions are considered in this context, in the age of globalization, higher education institutions have to adapt to the technological changes to improve their quality to attract their most valuable asset, their students. To adapt to the global changes, universities have to become more innovative and be ready for rapid changes caused by technology (Mohamed Hashim, Tlemsani & Matthews, 2021; Mok, 2008). Moreover, DT of higher education will offer many benefits to universities, such as attracting students and improving the programs' quality and teaching materials (Sá & Serpa, 2020). To take advantage of these benefits, DT seems inevitable. Technological drivers of DT in higher education are listed in the literature as cloud computing, artificial intelligence, IoT, digital games, augmented reality, 5G networks, social networks, and educational software by Oliveira and de Souza (2021).

During the Covid-19 Epidemic

The DT process in education is slower than in other domains. However, the Covid-19 epidemic has triggered the DT of higher education institutions (Bogdandy et al., 2020), which revealed a significant issue in the field. The covid-19 epidemic has offered an opportunity to create DT agenda for universities. Using online platforms has become mandatory with the Covid-19 epidemic worldwide. However, universities' strategic plans were not that way. Universities need DT strategies to rebuild their education models (Kane, 2017), provide continuous improvement (Mohamed Hashim et al., 2021) as well as to enhance productivity, create innovative practices, and develop a reputation (Matt, Hess & Benlian, 2015). The details and examples of DT in higher education during the Covid-19 epidemic are given in *The Covid-19 Epidemic and Digital Transformation of Education* section.

Examples of DT in Higher Education from Various Countries

Changes in higher education with technological improvements started in the 2000s, especially with ICT improvements. Technology has been used to support traditional classrooms. Later, teaching online courses began to be offered (VanSickle, 2003), the first implementation of DT in higher education. VanSickle (2003) published a guideline for teaching online courses. Similarly, Zsohar and Smith (2008) proposed principles to manage online courses with examples from WebCT, an online learning platform with tools such as discussion boards and chat. It was challenging to design the course, set the course guidelines, and decide on evaluation methods in earlier online education courses. Also, lack of face-to-face interaction and technology access challenges were the negative effects. These negative effects have been surpassed in today's technology.

The rationale behind DT is not only using technologies like in the earlier version of online learning; DT of education requires the redefinition of education services instead of publishing course contents online (Sandkuhl & Lehmann, 2017). For example, Rostock University has created a DT strategy and offered online courses based on MOOCs ("Massive Open Online Course"). With a Project called KOSMOS, they support their new course programs to develop new study formats. LMS is used as a portal to integrate learning objects and tools in KOSMOS. Their LMS, called MyKosmos, offers different functions such as search engine, integration of traditional LMS, supporting synchronous and asynchronous communication, and collaboration tools among students for document sharing and editing (Sandkuhl &

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Lehmann, 2017). On the other hand, Northern Michigan University started the DT process by establishing an online campus called Global Campus in 2016, aiming to create a digital educational environment to provide the same standard of education by face-to-face programs (Ngafeeson, 2021). The university set value creation goals to continuously improve the curricular design and acquire technology for education delivery. Global Campus has an operational model including four main components: online learning technologies, student support, faculty support, and administration (Ngafeeson, 2021).

For the DT process of German higher education, the German government has proposed a digital agenda to perform the societal, political, and economic transformation, including all education levels. According to the German government, DT is a way of knowledge transfer and scientific innovations. Also, they want all the citizens to be digitally literate to engage in educational activities (Bond et al., 2018). So, the German government has established a forum, the German Forum for Higher Education in the Digital age, to support the higher education institutions which want to implement DT strategies and deal with the different aspects of DT in higher education institutions, including internationalization, organizational change, and transformation of learning and teaching (Bond et al., 2018).

Government policies and institutional strategies should support the digitization of higher education. For example, the use of digital technologies in higher education has been supported by the government in the UK, and they have developed national strategies (Xiao, 2018). Munro (2018) analyzed and revealed that these strategies depend on digital technologies, aiming to marketize UK higher education by shaping the digitization of higher education institutions. Similarly, the Chinese government supported DT of higher education institutions with two laws published: "*The Education Law of the People's Republic of China"* and "*The Higher Education Law of the Republic of China."* These laws support technology use in education and access to educational resources (Xiao, 2018). Also, with the *"Outline of China's National Plan for Medium and Long-term Educational Reform and Development (2010-2020),"* the DT process was accelerated in terms of establishing digital infrastructure, improving teaching content, and the quality of educational resources (Xiao, 2018). With the digitization plan, they set goals depending on technology integration. The universities in Turkey have considered DT for the last ten years (Toprak et al., 2021). In this scope, Turkey's higher education council (YÖK) has proposed a project called the "Digital Transformation Project in Higher Education" to start the DT process with a pilot study in 8 universities in Turkey in 2018. In the scope of this project, the instructors of 8 universities have enrolled in a course "Learning and Teaching in Higher Education in the Digital Age" to prepare themselves and their universities for the DT process, to develop new skills for the DT and, to learn new approaches for learning and teaching. In 2019, another eight universities were added to the project (Kocaoğlu & Gezici, 2021). This project also aims to promote the use of LMS and open access resources. India started the SWAYAM program based on MOOCs as a start to DT of higher education. This platform aims to offer 200 courses for about 80000 hours to cover school, undergraduate, post-graduate levels, and professionals free of charge (Kanjilal & Kaul, 2016).

Recent technological examples of DT in higher education are communication and collaboration technologies, including cloud computing, social networking sites for educational purposes, web 2.0 collaboration tools, and document management systems (Wilms et al., 2017). The disruptive technologies seen at innovative universities include artificial intelligence, cloud computing, big data (Mohamed Hashim et al., 2021), and IoT (Abbasy& Quesada, 2017; Horowitz, 2015; Ilieva &Yankova, 2020).

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THE COVID-19 EPIDEMIC AND DIGITAL TRANSFORMATION OF EDUCATION

The Covid-19 epidemic was an unforeseen event for all the world, which has brought many challenges to people's daily lives. The first case of coronavirus was reported in December 2019 in China. Soon, World Health Organization (WHO) declared it an epidemic in March 2020. To prevent the spread of coronavirus, countries had to take restrictions. One of the challenging issues of the epidemic is related to crowded places because they cause the spread of the coronavirus quickly. Common measures taken to prevent the spread of coronavirus are social distancing, creating public awareness of the disease, and apps to track the patients and cases. Covid-19 Epidemic has essential effects on digitization in every part of human life, including work, spare time, social activities, banking, and education (Grek & Landri, 2021). In this scope, most governments in the world decided to suspend face-to-face classes at all levels of education. Universities have started to switch to distance education solutions to continue their education programs to provide social distance. However, universities' sociological and technological readiness for such an urgent transition to distance education was a big challenge. The Covid-19 pandemic has accelerated the DT of higher education globally, and universities have started to reorganize their education program to virtual platforms (Secundo et al., 2021). Higher education institutions' first step to achieve, forced by the Covid-19 epidemic, was to convert existing and new teaching materials to digital formats to deliver to students in a short time to continue educational activities as soon as possible (Dwivedi et al., 2020). Universities'/Schools' openings and closures have been affected by the number of coronavirus infections in many countries for about two years.

With the epidemic, two trends have become common in terms of DT in higher education: distance education and increasing innovations in universities (Kang, 2021). Different kinds of technologies have been used to support distance education in higher education across the world (Çaldağ, Gökalp & Alkış, 2021). Çaldağ et al. (2021) have categorized these technologies into five groups: LMS, MOOCs, video conferencing platforms, social media platforms, and digital learning content tools. These technological opportunities have been used to access materials, join virtual classes, share videos & audio, and documents, chat, and record and share lessons. Their use in the Covid-19 period has increased all over the world.

The technologies that have become common and been used to support distance education by different countries during the Covid-19 epidemic are listed in Table 1. Video conferencing tools such as Zoom, Microsoft Teams, and LMS are common among these technologies. The critical action during the Covid-19 epidemic was not to postpone the classes so that universities published course materials online via LMS and conducted online synchronous lessons via videoconferencing tools.

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Table 1. The technologies used during the Covid-19 epidemic in higher education across different countries

Technology & Platforms	Country	Reference
Mobile platforms & applications (Vodacom, Cell C, MTN), Web sites, Microsoft Teams, Skype, WhatsApp Groups, and Zoom	South Africa	Mhlanga & Moloi, 2020.
Microsoft Teams, Cisco WebEx, Google Meet & Blackboard	Italy	Cesco et al., 2021
Zoom	Ireland	
LMS	Cambodia	Heng, 2021
LMS (Moodle), GSuite for Education, Microsoft Teams, Google Meet, Google for Education	Ukraine	Grynyuk et al., 2020; Melnychenko & Zheliaskova, 2021
LMSs (Moodle), Zoom, Skype, Microsoft Teams and Webex	Spain	Iglesias-Pradas et al., 2021
LMS, Whatsapp, Telegram, E-mail, YouTube, Zoom, Cisco WebEx, Google Meet, Skype, Telephone, Google Classroom, Television channels, Webinar	India	Mishra, Gupta & Shree, 2020
Google Classroom, Edmodo, EdLink, Schoology, Zoom, Whatsapp	Indonesia	Ubaedillah & Pratiwi, 2021
MOOCs	Japan	Kang, 2021
Distance Learning, MOOCs	Canada	Wotto, 2020
	United States	
	France	
TelmidTICE, Microsoft Teams	Morocco	Nachit & Belhcen, 2020
Zoom, Microsoft Teams, Cisco Webex, LMS-Moodle	Turkey	Personal experience

Aristovnik et al. (2020) conducted global scale research to evaluate the impacts of Covid-19 on higher education students with the participation of 30383 students from 60 different countries. According to their findings, students are satisfied with the transition from face-to-face classes to online teaching and their teachers' support during this process. Especially, real-time video conference courses (use of zoom, MS Teams ...etc.) are more welcomed than other types of online methods. However, this research identified that applied science students, undergraduate students, part-time students, students from Africa (especially due to lack of ICT structure and internet), and Asia, and low-income students were negatively affected by the educational changes. On the other hand, students from social sciences, who had good living standards, and studied in Europe were more satisfied with their education and universities during Covid-19. These results should be beneficial for the further implementation of online learning according to disciplines, students' level, financial status, and location.

CHALLENGES OF DT IN HIGHER EDUCATION

DT has various advantages and challenges for organizations. While the advantages include digital workflows, new development strategies, efficiency in workflow, implementing new technologies, improving work quality and performance, and increasing productivity, the challenges include digital capabilities, defining leadership roles and responsibilities, cultural changes, lack of skills and IT foundation for DT, adaptation to new situations, and unfamiliar technologies (Hai et al., 2021). On the other hand, the chal-

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lenges of DT in higher education could be categorized into two parts: challenges related to digitization and challenges of the Covid-19 epidemic.

Digitization-related challenges include managerial and technical/technological challenges. Cesco et al. (2021) list technical challenges as network infrastructure (students and educators should have suitable internet access), availability of hardware devices (students and educators should have suitable devices including laptops, tablets, or smart phones), e-learning software, organization of teaching activities, pedagogical issues, diversity, and inclusivity. Sá and Serpa (2020) mentioned that to be successful and to benefit from its advantages, the digital transformation of higher education should be based on sustainable management (Sá & Serpa, 2020). Nurhas et al. (2021) list challenges of DT of higher education in three levels: individual level, group or interpersonal level, and organizational level. Individual-level challenges are related to issues of well-being, lack of online learning and teaching competencies, and difficulty in concentrating. Group-level challenges include social inclusion and diversity, which are caused by lack of interaction in a virtual environment. Lastly, organizational-level challenges include strategic development and strategies of the higher education institutions.

Bond et al. (2018) list the issues related to DT in higher education as follows:

- Innovations in education do not only include technological innovations; they should consist of academic, curricular, organizational, and structural innovations.
- Universities do not lack technological innovations; they lack strategic improvements
- Use of digital media improves education quality
- Integration of technology into teaching and education is a comprehensive task and requires the engagement of different stakeholders.

Challenges of the Covid-19 epidemic on mostly related to the fast transformation from face-to-face classes to distance education. This causes adaptation problems to technology-based education (including online learning and e-learning). The countries Sri Lanka and Bangladesh faced this challenge during the Covid-19 epidemic (Ewing, 2021). Developing countries have infrastructure-based challenges for digitization, including poor internet service and lack of infrastructure. According to Bhagat and Kim (2020), challenges of fast transformation to online learning due to the Covid-19 epidemic include preparedness (poor management and limited access to the internet so to the resources), quality concerns for online learning, finances for both students and institutions, and online delivery. Although there are various challenges, it is obvious that DT of higher education will provide many benefits to higher education institutions, including attracting students, improving the quality of study programs, and improving the quality of teaching materials (Sá & Serpa, 2020).

GENERAL EVALUATION AND SUGGESTIONS

This book chapter evaluated the international literature to highlight the current situation of DT in higher education, the impacts of Covid-19, and the challenges and reflections of DT in higher education. There are many studies in the literature related to DT in higher education especially related to the Covid-19 epidemic and its challenges. DT of higher education is inevitable in this digital age. Universities have started the DT process by using e-learning software, especially LMS, offering online courses and programs.

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The Covid-19 epidemic has triggered these processes and forced universities to use digital technologies. This chapter has made various inferences from the current literature as follows:

- DT should be considered as a societal and cultural revolution instead of a technological revolution.
- DT in higher education should not depend on only technology since just publishing course content online is not enough for DT in higher education. DT in higher education should be supported with strategic plans, educational and institutional policies, guidelines, governmental support, new learning, and teaching methods.
- Covid-19 epidemic has forced educational institutions to implement online learning and distance education. Fast transformation to online learning triggered the DT in higher education.
- All stakeholders in higher education should involve in the DT process.
- DT of higher education is essential to increase the quality of the programs in this digital age.
- There are various kinds of challenges in DT of higher education. Technological challenges are based on the income rates of the countries, while managerial challenges are based on lack of strategies.
- To succeed in DT of higher education, the challenges listed in the section "Challenges of DT in Higher Education" should be considered by all the stakeholders.
- There are technological obstacles in front of the DT of education for developing countries.
- Although there are good examples, the literature needs more practical studies of DT in higher education, especially different experiences from different countries, to help and guide the universities to take action.
- Training programs should be arranged for DT of higher education.
- Common implementation of DT in higher education includes online learning implementation with digital learning materials, LMS, and synchronous lectures with video conferencing tools.
- There are digital technologies to support DT in higher education. These technological opportunities are categorized as LMS, MOOCs, video conferencing platforms, social media platforms, and digital learning content tools. Although there is such a wide range of technological opportunities, there is a need for an integrated system including all functionalities together.
- The Joint Research Centre (JRC) has published a conceptual model (Given in Appendix 1). This model could be a reference model to evaluate the digital competencies of universities and DT processes to integrate and use digital educational technologies.

CONCLUSION

In conclusion, the current research in the literature shows that DT is inevitable for every part of our lives. Higher education institutions have to adapt to the changes of digitization to attract their students and improve their quality. Universities have started their DT processes by integrating technologies into educational processes, especially during the Covid-19 epidemic; distance education classes have been conducted over educational technologies. However, the literature needs more practical examples, such as case studies of the use and integration of new digital technologies into higher education with their strategic plans.

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KEY TERMS AND DEFINITIONS

Digital Technologies: Electronic technologies and tools that are used to create, store and process data (e.g., social media, mobile phones, etc.).

Digital Transformation: The changes in human life caused by new digital technologies.

Distance Education: Education that takes place when a teacher and student(s) are separated by physical distance, and technology is used to bridge the instructional gap.

E-Learning: A learning platform that uses information technologies to conduct learning and teaching activities.

Education 4.0: An approach to learning and teaching that comes with the fourth industrial revolution and a transformation of education using advanced technologies/digital transformation of education by the support of technology, organizational, and pedagogical changes.

Innovation: A new idea, method, or device, novelty.

Mobile Learning: The use of mobile technologies to reach learning content.

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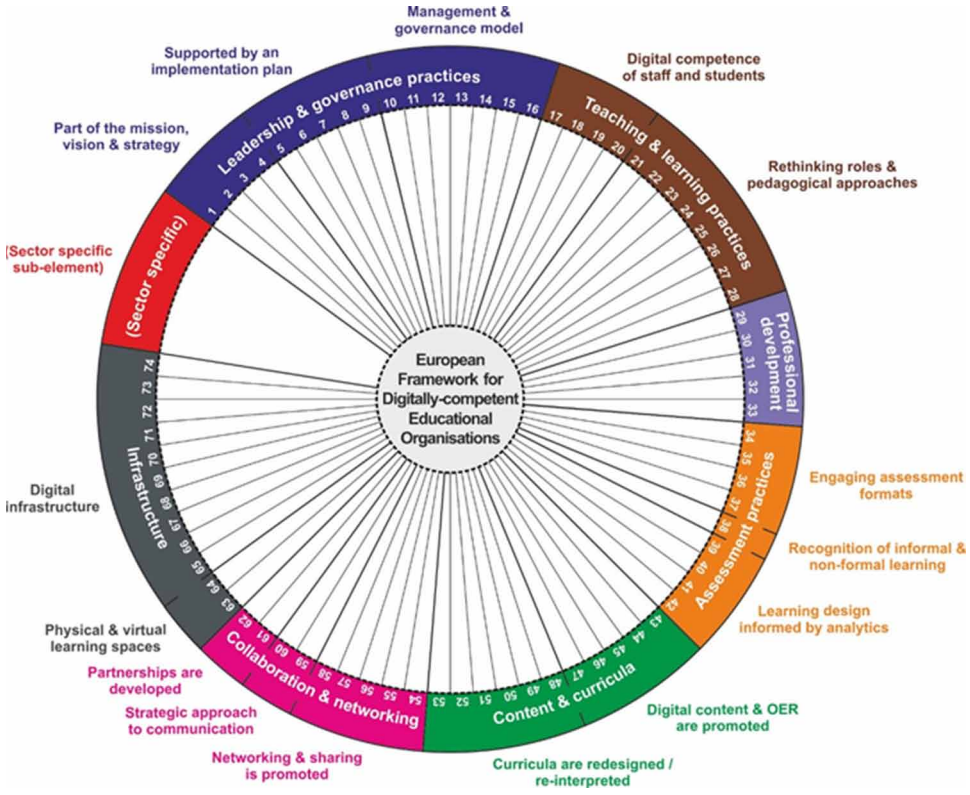
Online Learning: A learning approach in which students enroll in courses in fully virtual learning environments.

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APPENDIX

For the self-evaluation of educational organizations, to use and integrate the digital technologies, The JRC has published a conceptual model (given in Figure 1). This model has 74 indicators interrelated and interdependent and it aims to create a base for the development of strategies for every level of education for the digital age.

Figure 1. The European Framework for Digitally-Competent Educational Organisations (DigCompOrg) (Source: Kampylis, Punie & Devine, 2015).



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Chapter 4
E-Learning Critical Success Factors Impacts on Learner Satisfaction and Outcomes

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ABSTRACT

E-learning is an ever-changing concept, and many theories have been developed and studied for it. The common aptitude test for management schools in India started online in 2009, and almost all coaching firms, like testing firms, are migrating online. Furthermore, the current pandemic COVID-19 has required all participants in learning to be online for the previous year and a half. Therefore, the present study is designed to analyse the causal relationship of the factors affecting learners perceived-learning-outcomes-and-satisfaction of e-learning in the preparation of graduate admission tests. The results concluded that effective and constructive conversation among students, as well as between students and instructors, has a substantial and beneficial impact on learning outcomes. In addition, the course objectives and strategy, module structure, course content supplied to students, and grading component designs are all critical for an online class. The study is useful for e-learning educators, managers, and legislators.

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INTRODUCTION

E-learning bridges the gap between learning and technology. In the previous two decades, there has been a rise in study on e-learning terminology and learning methods in higher education (Wu, 2016; Tsai, Shen, & Chiang, 2013). Due to the variety of technology and methodologies used for online learning, e-learning encompasses a wide range of approaches and behaviours (Clarke, 2007). Learners access the course via correspondence, e-mail, printed material, recorded audios, on-demand videos, virtual laboratories, computer-assisted instructions, synchronous or asynchronous communication, web-based material, multimedia, simulation and gaming, wireless/handheld devices, and other means in an online setting (Hiltz & Turoff, 2005). The researchers have revealed that the e-learning enhances their learning outcome and increases the satisfaction among students (Islam and Sheikh, 2019; Chopra, Madan, Jaisingh and Bhaskar; 2019). The factors like course quality, course structure, interactivity, faculty, style of learning, availability of course, flexibility and quality of tutorials, quality of technology and mentorship are the reasons for choice of e-learning mode by students (Freeman and Urbaczewski, 2019; Harsasi and Sutawijaya, 2018). The relevance of online courses for industry also increases the satisfaction level of learners (Eom and Ashill, 2016).

Concept of E-learning

E-learning is a concept that is always changing. In various studies, several concepts have been coined and explained. In 1955, a concept known as CAI (Computer-Assisted Instruction) was proposed as a method of teaching problem-solving skills (Zinn, 2000). Concepts of computer assisted learning have been investigated in a variety of ways. Some of these emphasise the use of technology, while others emphasise communication (Mason & Rennie, 2006). E-learning at universities and educational institutions has grown as a result of new technological breakthroughs that make it easier to learn online. As e-learning has grown in popularity, new technologies such as user interfaces and templates for creating course structures with varied features for e-learners have emerged. Blackboard, Moodle, and WebCT are some of the most popular Learning Management Systems (Alexander & Golja, 2007; Coates, James, & Baldwin, 2005). E-learning is defined as learning delivered online, over the internet, in a variety of formats, including distant education, computerised electronic learning, online learning, internet learning, and others. It refers to when students take courses that are provided through the internet to locations other than the classroom or where the professor is teaching. Learners can communicate with teachers, professors, and other students in the class in addition to self-learning via the internet. It is sometimes provided live, with real-time interaction, and other times it is a pre-recorded lecture (Chawla & Joshi, 2012). Although e-learning allows for more individualised learning and collaboration with peers and experts (Pillay, Irving & Tones, 2007), it requires a high level of self-control, self-direction, and self-regulation (Edmundson, 2009; Wong, 2007). Previous research has discovered that e-learning has a number of disadvantages, including decreased satisfaction, decreased interest, increased frustration, low instructor engagement/interaction, poor peer engagement, learning, and relationships, dropouts, a lack of feedback, ambiguity surrounding class schedules or requirements, overwhelming online discussions, and an overflow of information from emails. According to researchers, internet-based or online-delivered education has resulted in a decrease in educational quality. Learners' lack of preparedness for e-learning or technology-enhanced learning may contribute to low satisfaction and learning outcomes, as well as the adoption of user-friendly LMSs (learning management systems) (Diep, Zhu, Struyven & Blieck,

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2016). According to the findings, learners' readiness for e-learning should be evaluated based on their familiarity with the internet or technology. The effort and instructions should be taken to set the learners' expectations correctly for a successful learning outcome and overall improved student experience (Coates et al., 2005; Engelbrecht, 2005; Paechter, Maier & Macher, 2010 ; Alexander & Golja, 2007; Engelbrecht, 2005). The role of instructor in e-learning set-up is very crucial. Their active participation is required to motivate the students to interact in online classrooms (Ekwunife-Orakwue and Teng, 2014) . When it comes to student motivation, enjoyment, and interaction, the online learning environment is worlds apart from the traditional classroom setting (Bignoux & Sund, 2018).

Traditionally described as classroom instruction, education is today provided through a variety of methods that use variable degrees of technology and teacher interaction. Internet access has played a critical role in the rapid growth of e-learning in schools and higher education institutions. A larger internet environment, populated by a diverse array of local and foreign businesses, is accelerating the adoption of online education. India's e-learning potential is immense, since the country's internet usage is anticipated to surpass 250 million people, putting it on a par with the United States and China (Hughes Report, 2014). India has 1.4 million schools, 36,000 higher education institutions, and 227 million students registered in one of the formal education systems, making it easily one of the world's largest education sectors. (https://www.ibef.org/, 2017). With these figures, the target sector for education and related services accounts for about half of the country's 1.2 billion-strong population. India's demographics, internet penetration, and the government's drive to raise gross enrolment have paved the path for the country to become a profitable market for e-learning. With this environment in place, India becomes the second largest e-learning market behind the United States. India's gross enrolment ratio in education (GER) remains low, despite its population advantage. The government is pursuing several measures to enhance GER by investing in education's scalability and accessibility. According to the UK-India Business Council, the government would invest INR 1.13 trillion in the industry as part of its digital media plan. The online education industry in India, which was predicted to have 1.6 million users in 2016, is expected to grow to 9.6 million users by 2021, resulting in a $1.96 billion market. The exam preparation market in India is increasing at a 64 percent compound annual growth rate (KPMG-Google, 2017). E-learning is a notion that is always changing. Several ideas have been invented and explicated in numerous studies. The initial notion, dubbed CAI (Computer-Assisted Instruction), came in 1955 as a method of teaching problem-solving (Zinn, 2000). Traditionally described as classroom-based instruction, education is today provided through a variety of methods that use variable degrees of technology and teacher interaction. Internet access has played a critical role in the rapid growth of e-learning in schools and higher education institutions. A crowded internet environment, populated by a diverse array of local and foreign businesses, is accelerating the adoption of online education. India's e-learning potential is immense, since the country's internet usage is anticipated to surpass 250 million people, putting it on a par with the United States and China (Hughes Report, 2014). The satisfaction of learners with e-learning has been evaluated for a variety of courses in the management area and allied subjects. Nonetheless, there is considerable room for future studies. Additionally, based on the assessment of the literature conducted thus far, it appears that sufficient research has been conducted in management education, especially for generic courses. Within management, there is a dearth of research on test preparation for Management Education and the market for test preparation coaching with the goal of increasing learner satisfaction and learning outcome.

In India, most educational systems adhere to the old paradigm of instructor-led classroom instruction with limited or no use of technology resources. Digital media has improved university students'

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and instructors' teaching and learning experiences, and it has fast become commonplace (Engelbrecht, 2005; Liaw, Huang, & Chen, 2007). In India, traditional classroom lecture methods and e-learning are still in their infancy in management education. The use of a technology-enabled platform to disseminate courses and share content has not resulted in the acquisition of high-quality learning; rather, technology is being used to convey existing learning frameworks. The quality of e-learning programmes hasn't necessarily improved as penetration has increased. Student engagement, retention, perceived effectiveness, and satisfaction in online delivery, on the other hand, must all be considered. Students' acceptance of e-learning and the value obtained is still up in the air (Chawla & Joshi 2012; Technopak Report, 2016), For business schools, the online delivery of education is becoming increasingly important. With the rising importance, there has been an increase in research interest in the study of various formats and degrees of e-learning in business education, ranging from pure online i.e. self-paced to hybrid format to instructor-based online delivery. Such study has been undertaken in the e-learning and technology sectors, with an emphasis on earlier breakthroughs as well as enhancing the learning experience through platforms. Despite the fact that numerous studies have shown that online courses are comparable to their classroom-based counterparts (Popovich & Neel, 2005; Sitzmann, Kraiger, Stewart, & Wisher, 2006; Zhao et al, 2005). Other research have demonstrated that online learning has been relatively indifferent to the work that comes from the business disciplines in the past (Bernard et al., 2004; Larreamendy-Joerns & Leinhardt, 2006; Moos & Azevedo, 2009; Tallent-Runnels et al., 2006).

The Common Aptitude Test (CAT), a prominent and challenging entrance exam used in India to select applicants for management school admission, became online in 2009. It was designed in the same way as many other management entrance tests in the US, such as the GMAT (Graduate Management Aptitude Test) and the GRE (Graduate Record Examination). While testing organisations have switched their tests to online platforms, coaching firms are doing the same. Exam preparation is the fastest-growing aspect of education, and the online distribution method will be widely adopted. Existing physical test preparation tutoring centres could be replaced or supplemented with internet platforms. The online test preparation business has grown at a compound annual growth rate of 14 percent in recent years, with a market value of $11 billion predicted by 2021(2017 Google KPMG report). The government is also assisting the sector's development by investing in e-learning programmes and maintaining appropriations for faculty training in online delivery methods, to facilitate smooth transitions for students from classroom contexts to self-directed learning, faculty roles and competencies expand (Rao, 2011). Therefore the objective of the current study is to analyse the causal relationship of the factors affecting learners perceived-learning-outcomes-and-satisfaction of e-learning in the preparation of Graduate Admission Tests. In the following section the theoretical framework for the study is discussed in detail.

RESEARCH GAP AND NEED OF STUDY

An earlier study looked at how various courses in the standard curriculum of colleges and schools may be delivered using electronic learning techniques. However, the following topics have received insufficient attention from scientists. Therefore, the present study is required to examine/study the aspects impacting learner's satisfaction in e-learning ways of teaching, learners' learning outcomes from e-learning techniques of mentoring should be investigated and to analyze the determinants (e-learning in coaching company) of learner's learning result and satisfaction level on the basis of their significance.

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HYPOTHESIS OF THE STUDY

The research hypothesized, based on the preceding discussion, that a greater degree of perceived interaction between Instructor-student and student-student would result in a better level of learning outcome and level of satisfaction. Following is the hypothesis of the present study.

Dialogue- Higher levels of instructor-student and student-student communication are associated with improved learning outcomes and student satisfaction.

Instructor- Effective teacher behavior in online courses are associated with better levels of satisfaction and learning outcomes.

Course design- Students who believe in online course design report greater pleasure and learning outcomes.

Students' Motivation- Students who are more motivated (both intrinsic and extrinsic) in an online course will report better levels of user satisfaction and learning outcomes.

Self-regulation- Students having a greater degree of self-regulation in online courses will report higher levels of satisfaction and outcome.

THEORETICAL FRAMEWORK

The constructivist models of learning (Piaget, 1977) are used to define the features of e-learning in this study, and this model provides a theoretical foundation for the study of the e-learning environment (Jonassen, Davidson, Collins, & Haag, 1995). This model's premise is that knowledge is generated, unlike objectivist or behaviourist learning theories argue that knowledge is transferred from instructor to students (Vygotsky, 1978). Different models of learning, such as facilitated learning (Rodgers, 1983), socio culturism, collaborativism, and the cognitive information processing model (Leidner & Jarvenpaa, 1995), and discovery learning, are considered extensions of the constructivist paradigm (Vygotsky, 1978; Bruner, 1985). All of the studies described above agree that knowledge cannot be taught; rather, it must be produced; nevertheless, these studies disagree on the optimal method for creating knowledge. One element of the constructivist model is that knowledge is constructed discretely and independently. It also believes that students learn best when they learn at their own speed and in their own time. Students must be self-regulated and active learners in order to succeed in this learning process. Pintrich and DeGroot (1990) bring a different perspective. They think that self-regulated learning techniques alone will not help students accomplish their goals; instead, students must be encouraged to use self-regulated learning ways. According to Smith (2001), self-motivation is the foundation of self-regulated learning. Another premise of the constructivism model is the evolving role of instructors. Their position has shifted from being the centre of attention to that of creative moderators and facilitators of the learning process. The figure-1 depicts one basic constructivist model of learning as stated by Leidner and Jarvenpaa (1995). This contains the constructivist learning models' goals, main assumptions, and implications. The two fundamental constructs of the current study are learning outcome and satisfaction, which are the outputs of the aforementioned model.

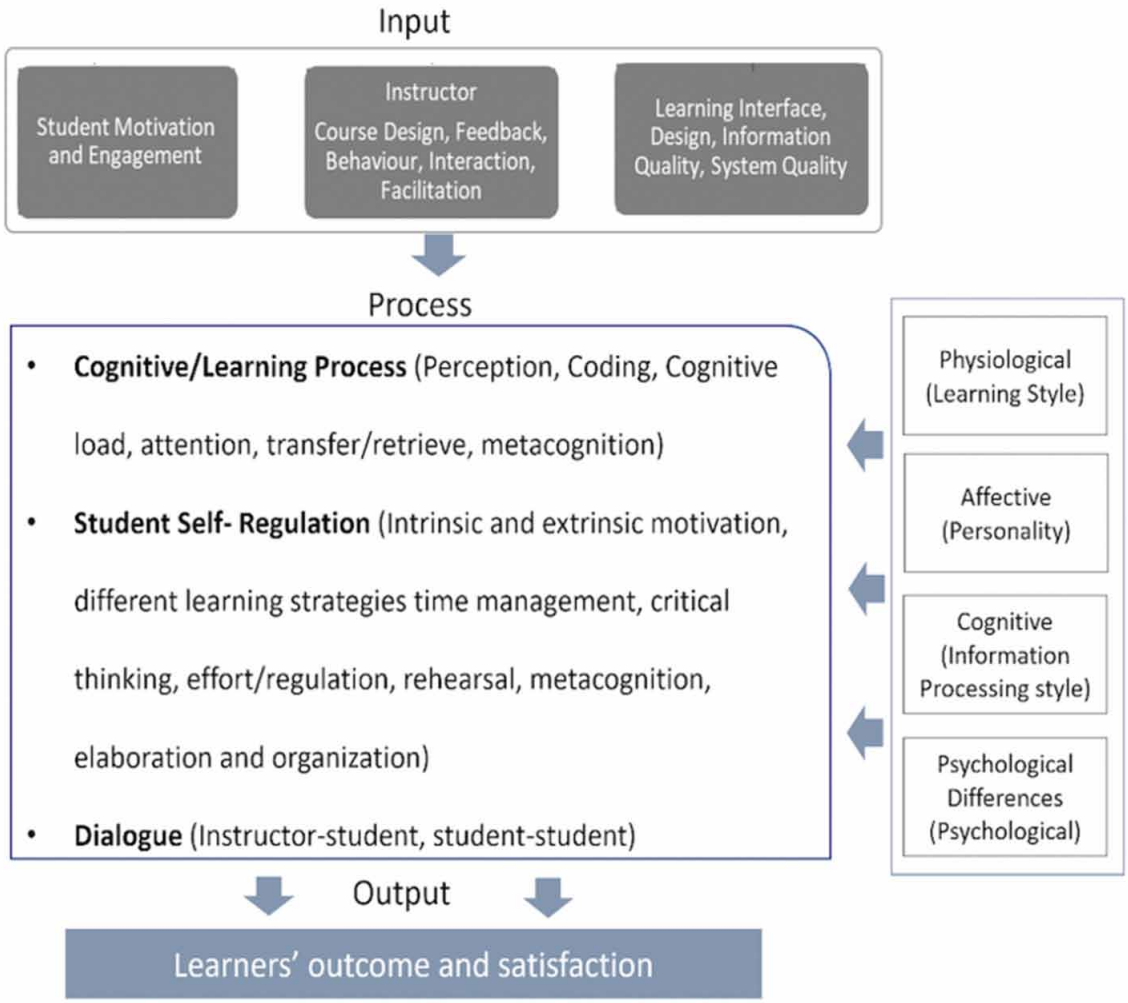
For this study, e-learning is defined as the interaction of three bodies: the learner, the instructor, and the learning management system (LMS), which includes course design, motivation, student self-regulation, and dialogues (instructor and student-student), among other things. These entities are constantly interacting with one another and their surroundings in order to improve learning outcomes and student

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satisfaction. The theoretical underpinning of the research model for this study is built on constructivist learning theories (which have already been described in previous paragraphs), and the suggested model for this study is derived from a combination of two models. Piccoli et. al., (2001) proposed the Virtual Learning Environment effectiveness model, while Alavi and Leidner (2001) proposed the Framework for Technology Mediated Learning. The figure 1 is a concise overview of these two models. The virtual learning environment is a computer system with specialised learning management software that allows learners and instructors to plan, organise, monitor, coordinate, and regulate learning activities in order to facilitate the learning process and improve the desired learning outcome. To determine the success and efficiency of an e-learning system, the Virtual Learning Environment model considers both the human and design dimensions. The human component is concerned with instructors and students and their different qualities, whereas the design aspect is concerned with the LMS, course design, self-regulation, and human-to-human contact. The current study's conceptual model takes into account three elements of e-learning: instructor, learner, and system, all of which are necessary components of the e-learning ecosystem in order to improve the e-learning result, i.e. learning outcome and learner's satisfaction. A virtual learning environment and a learning management system are frequently used interchangeably. The instructor designs and achieves one form of learning result, which is defined in the course design and structure. The other type of learning outcome is based on two types of procedures. The informational strategy and the instructional strategy are the two primary inputs to the technology mediated learning model. These influence psychological learning processes, which in turn influence learning outcomes, such as the learner's emotional response to e-learning, or satisfaction. The second process defined two psychological and cognitive student learning processes that were interconnected.

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Figure 1. Constructivist Model of Learning
Source: Leidner and Jarvenpaa (1995)



RESEARCH METHODOLOGY

As the objective of the current research is to study the causal relationship of the factors affecting learners perceived-learning-outcomes-and-satisfaction of e-learning in the preparation of Graduate Admission Tests, the following section will discuss about the research instrument designing, methods, sample etc.

Data Inputs, Instrument Development and Research Methods

The current research is based on primary data and is descriptive and causal in nature. The required data was obtained through a structured questionnaire. The research instrument was designed after a careful scrutiny of extant literature (Eom et al., 2006, IDEA (Individual Development and Educational Assessment, Shia, 1998, Stratil, 1988, Pintrich, Smith, Garcia & McKeachie, 1991 etc.) on critical success

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factors of e-learning. Initially a list of eighty-four (84) items was created to measure the determinants of learner's perceived learning outcome and satisfaction from e-learning in preparation of Graduate Admission Test. This first draft of questionnaire was sent to experts (having more than 15 years of experience in the field of study and also had experience of online teaching) from industry (9) and academia (11) for their inputs before making a final draft of the questionnaire. A set of 24 students selected randomly were also sent first draft of questionnaire to get feedback. Based on the suggestions of experts and students, many statements were removed from the first draft of instrument (as there were two or more than two statements capturing same behavioural aspect, removal of some unclear statements) and the research instrument administered for pilot testing had 42 items. All items were measured on a five point Likert scale. The questionnaire was administered on a sample of 400 respondents of which 138 respondents replied. This data was used for pilot testing. The overall Cronbach's alpha-coefficient was 0.883 which is much higher than the acceptable limit of 0.70 (Nunnaly, 1978). In order to accomplish the objectives of study, we started with factor extraction for which exploratory factor analysis (EFA) using Principle component analysis (PCA) with varimax rotation was used. After defining the latent variables, the study under consideration applied CFA (Confirmatory factor analysis) to obtain the measurement model. (Detailed explanation of the EFA and CFA is presented under 'Analysis of Results' heading)

Target Population

The target population is estimations are based on industry experts, conversation with and data of test preparation companies:

- The number of preparers is more than the test takers. The number of test preparers are 30% more than test takers. (Source: Interactions with and data of test preparation organizations, MCA reports)
- Online Graduate Admission Test preparers for online including self-prep, blended, and instructor led is taken at 28%. (Source: Interactions with and data of test preparation organizations, MCA reports)
- Online Graduate Admission Test preparers for instructor led is taken at 7%. (Source: Interactions with and data of test preparation organizations, MCA reports)
- The online test prep market is growing at 64% (Source: Google KPMG report 2017).

The total market size for instructor enabled online graduate admission test prep is assumed to be 91,000 preparers. This number is growing at a rate of 64%. The sampling was done with students in 3rd and 4th year engineering and management colleges from Metro towns - Delhi, Hyderabad, Bengaluru and Chennai. These students had prepared for graduate tests at least once in online mode. The *non-probability (convenience) & purposive-sampling method* was applied to have final sample. Students above the age of eighteen years were included in the study. Individual having above mentioned qualification is sample unit for the study.

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Table 1. Estimation of the Total Population size: Test Takers

	Total test takers	Test Preparers	Test Preparers	Total Online	Online preparers		Instructor Enabled	Market Value (Cr)	Avg. Price
IELTS	700000	30%	910000	30%	273000	7%	63700	57	9000
TOEFL	100000		130000	20%	26000		9100	8	9000
PTE	100000		130000	20%	26000		9100	8	9000
GMAT	27000		35100	30%	10530		2457	4	15000
GRE	75000		97500	30%	29250		6825	10	15000
No of Learners	1002000		1302600		364780		91182	88	
Instructor enabled online coaching		7%	91182						
@avg price in Cr (Market Value)		9600	88						

Source: IELTS, TOEFL, PTA - From industry sources and test making organizations, GMAT and GRE - Reports published by GMAC and ETS respectively, MCA and financial reports, growth rate of test preparation companies

As the objective of the study is to examine the impact of critical success factor of e-learning on perceived learning outcome and student's satisfaction therefore two separate measurement models were made for this purpose. The causal relationship was examined through *Structural Equation Modeling (SEM)* and before that the convergent reliability and discriminant validity of the constructs was tested. A non-probability and purposive sampling method was used to collect the data. For EFA, the questionnaire was administered on 1450 respondents and 659 respondents replied of which 68 surveys were discarded in the process of data cleaning and editing. A final data set of 591 respondents was used to extract the factors through factor analysis. For confirmatory factor analysis a fresh survey was administered on 1850 respondents and 738 questionnaires were received back. Out of these 738 responses, 154 questionnaires were eliminated in the process of data cleaning and a final data set of 584 respondents was used for validating the survey instrument.

RESULTS AND ANALYSIS OF THE DATA

The exploratory factor analysis was the first step in the data analysis procedure. For this, Principal Component Analysis (PCA) was used. Previously, the Kaiser-Meyer-Olkin (0.893) and Bartlett's Test of sphericity (found significant at the 5% level) results confirmed that the data was PCA-eligible. After then, the communalities for 38 statements (38/42 statements) were obtained. The value of communalities in four statements was less than 0.3/0.4, and there was also an issue with cross loading, thus these four statements were removed. One of these four claims is about the instructor, one is about dialogues, and the other two are about the course design. The lowest value of communalities is 0.552, while the highest value is 0.710. According to PCA results, the overall variance explained by the study's seven factors is 63.564 percent. We have also checked the reliability of constructs with the help of Cronbach's alpha. All the seven constructs of the study have a Cronbach alpha coefficient above 0.8. Further, among these seven factors, motivation (both external and internal), self-regulation, dialogue (both instructor-student and student-student), instructor, and course design were chosen as independent variables. The learner's

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perceived learning outcome and satisfaction were used as dependent variables in a subsequent study based on structural equation modelling. However, the findings were acquired for CFA in order to test the hypothesis that the learner's perceived learning outcome and satisfaction with e-learning in the preparation of the graduate entrance examination is a five-factor structure, as previously established. For CFA, a new sample of 584 respondents was used. The same sample was utilised to establish a causal relationship using structural equation modelling. Measurement model 1 has confirmed that the learner's perceived learning outcome of e-learning in the preparation of graduate admission test can be explained by five factors, i.e., Mvtn, SR, Dislg, Instr and CD. Measure mode 2 has confirmed that the learner's perceived satisfaction of e-learning in the preparation of graduate admission test can be explained by five factors, i.e., Mvtn, SR, Dislg, Instr and CD. Further, to confirm goodness fit of the model the researchers have developed several modified fit indices for the model fitting process and hypothesis testing (Marsh, Hau, Balla, & Grayson, 1988; Gerbing & Anderson, 1993; Tanaka, 1993; Hu & Bentler, 1995; MacCallum, Browne & Sugawara, 1996). The most important statistics used for model fitting process are CMIN/DF (Wheaton, Muthén, Alwin, & Summers, 1977) RMR, GFI, AGFI, and PGFI. Table 2 given has shown the summary of essential statistics to confirm model fitness.

Table 2. Results of Discriminant Validity

Method 1			**Method 2**		
	SS (Students' Satisfaction)	**Factors**		**SS(Students' Satisfaction)**	**Factors**
SS(Students' Satisfaction)	1.000		SS (Students' Satisfaction)	0.494	
Factors	0.357	1.000	Factors	0.127	0.401
SS (Students' Satisfaction)	0.703				
Factors	0.357	0.633			

Source: Author's compilation

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Table 3. Summary results of Model 1 and Model 2 of the study

	Benchmark	**Model 1** *Learning Outcome*	**Model 2** *learner's satisfaction*
X^2 test		779.871 with a zero (0.000) probability suggested that the hypothesized model is not completely adequate	759.550 with a zero (0.000) probability suggested that the hypothesized model is not completely adequate
CMIN/DF	2-5 is acceptable (Tabachnick and Fidell, 2007 and Wheaton et al, 1977	1.497	1.458
RMR (standardized root mean square residual)	0.05 or less	0.071	0.071
GFI (Goodness-of-fit Index)	a cut-off of 0.9 is considered good for a best-fit model MacCallum & Hong, 1997	0.929	0.930
AGFI (adjusted Goodness-of-fit Index)		0.919	0.920
PGFI (Parsimony Goodness-of-Fit Index)	James, Mulaik & Brett (1982)	0.813	0.814
NFI (Normed Fit Index)	close to or more than 0.95 Bentler, 1992 and Hu & Bentler, 1999 a value more than 0.90 indicates a good-fit (Bentler & Bonnet, 1980)	0.922	0.922
CFI (Comparative Fit Index)	close to or more than 0.95 Bentler, 1992 and Hu & Bentler, 1999 a value more than 0.90 indicates a good-fit (Bentler & Bonnet, 1980)	0.973	0.974
RFI (Relative Fit Index)	having value around 0.95 supports that model is a good fit	0.916	0.916
IFI (Incremental Index of Fit)	Bentler, 1992 and Hu & Bentler, 1999	0.973	0.974
TLI (Tucker-Lewis Index)		0.970	0.972
PRATIO (parsimony ratio)	lie even in a region of 0.5 (Mulaik et al, 1989) while other indices are preferred having value more than 0.9	0.929	0.929

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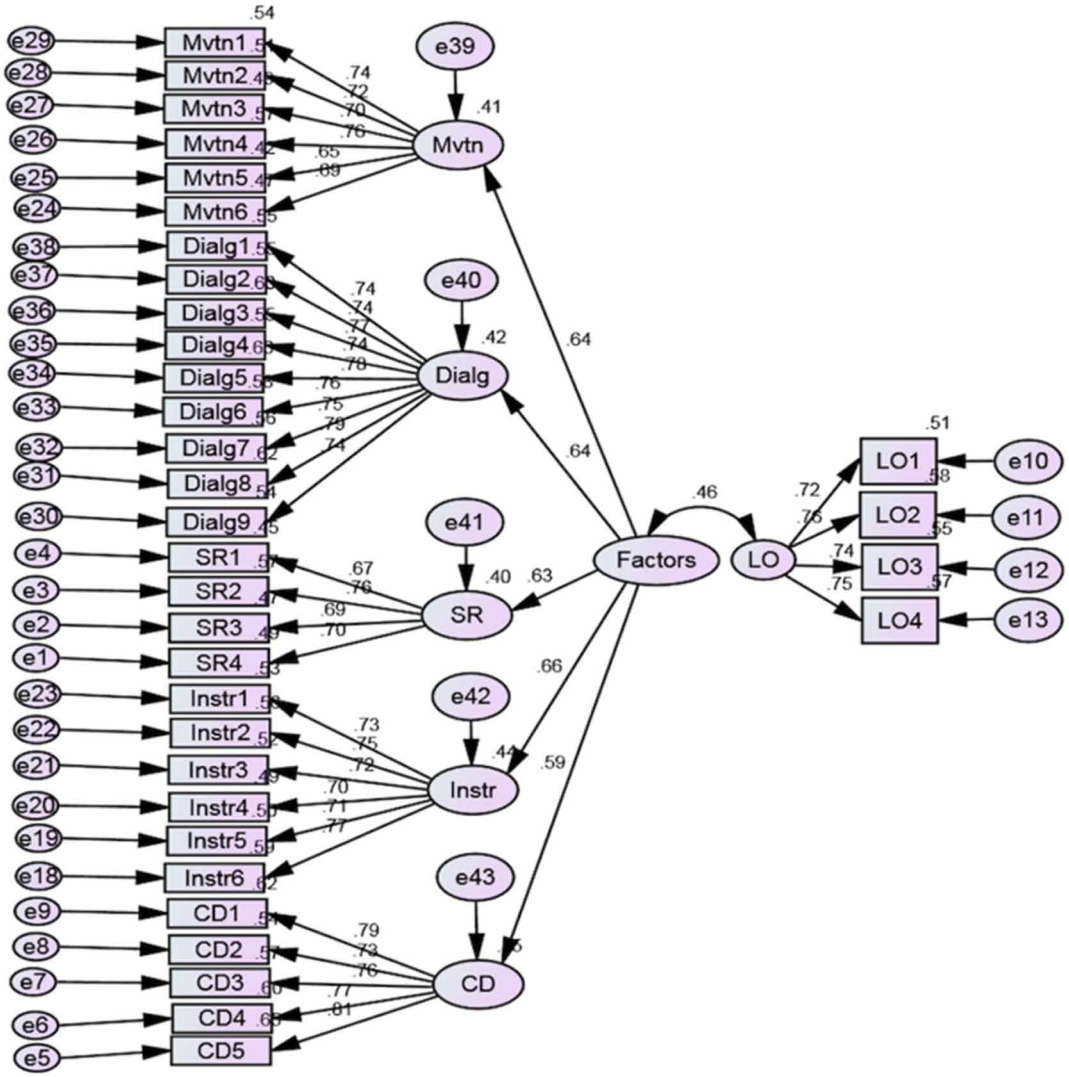
Table 3. Continued

	Benchmark	**Model 1** *Learning Outcome*	**Model 2** *learner's satisfaction*
PNFI (Parsimonious Normed Fit Index)		0.856	0.856
PCFI		0.903	0.905
FMIN	less than 1.0	Yes	Yes
RMSEA	less than 0.05 is good fit MacCallum et al., 1996	0.029	0.028
compare the default model of the study with saturated model and independence model		The t value of default model for all AIC (Akaike's (1987) Information Criterion), BCC (Browne-Cudeck Criterion (1989)), BIC (Bayes Information Criterion (Raftery, 1993; Schwartz, 1978)) and CAIC (consistent version of the AIC (Bozdogan's (1987)) is lesser than saturated model and independence model hence indicate the hypothesized model is best fit to data.	The t value of default model for all AIC (Akaike's (1987) Information Criterion), BCC (Browne-Cudeck Criterion (1989)), BIC (Bayes Information Criterion (Raftery, 1993; Schwartz, 1978)) and CAIC (consistent version of the AIC (Bozdogan's (1987)) is lesser than saturated model and independence model hence indicate the hypothesized model is best fit to data.
ECVI (Expected Cross-Validation Index)		1.592 lesser than saturated model (2.041) and independence model (17.252)	1.557 lesser than saturated model (2.041) and independence model (16.863)
Hoelter's index	more than 200 (Hu & Bentler, 1995)	431 and 448	442* and 460**

*Significant at 5%, ** Significant at 1%, Source: Author's compilation

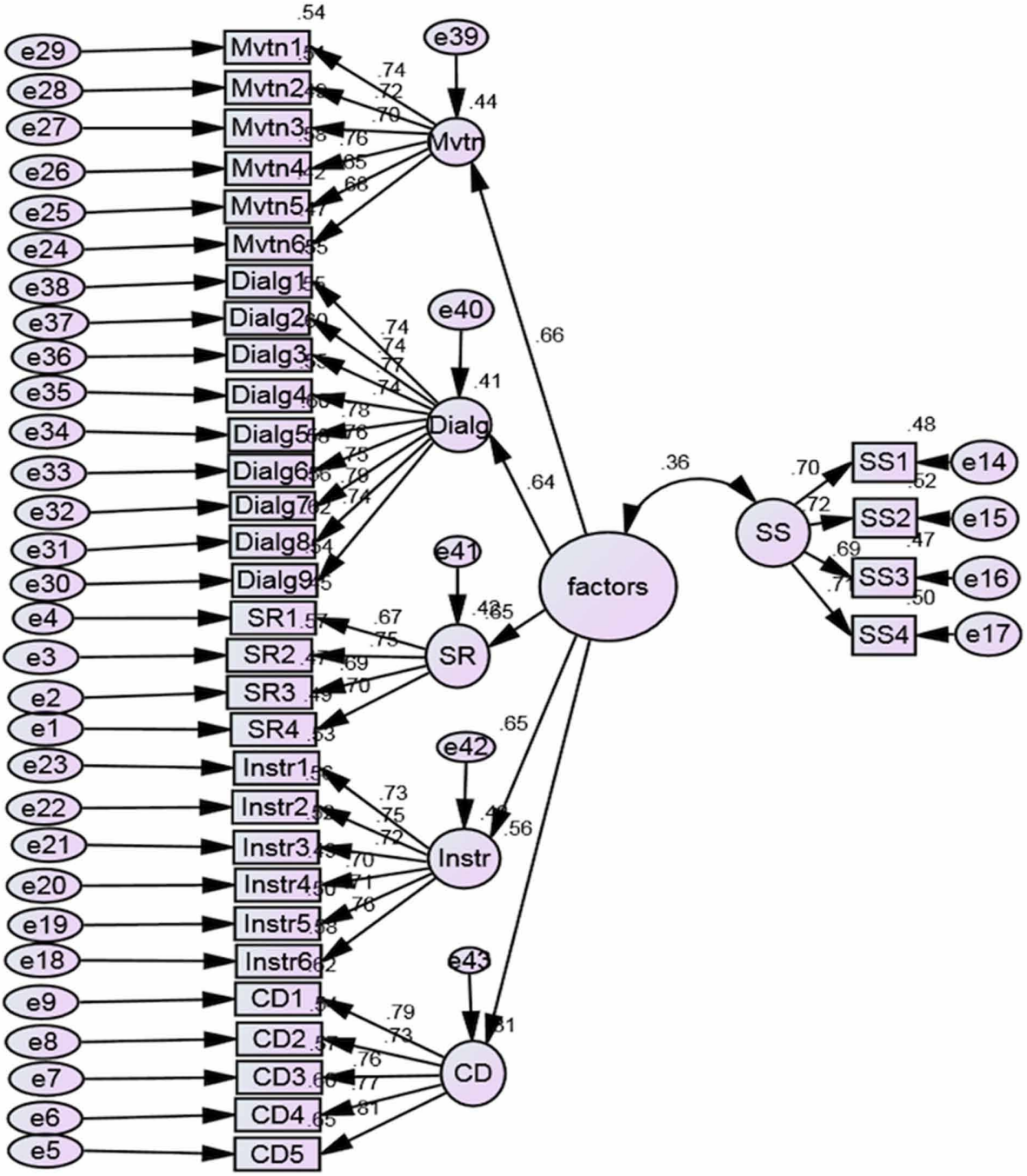
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Figure 2. Measurement Model 1 of the Study



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Figure 3. Measurement Model 2 of the study



Results from Second Order Structural Equation Modeling (SEM)

The causal relationship between (i) Learning outcome (LO) and critical success factors (Factors) of e-learning, and (ii) Students' satisfaction (SS) and critical success factors (Factors) of e-learning, was

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established after the satisfactory results of scale validation (as discussed in the preceding section). To investigate the aforementioned two causal linkages, the following two structural models were studied. Because the study's five e-learning drivers were regarded key success criteria, both of the models below are of second order. Table 4 shows the standardised regression estimates for both models. The standardised regression estimates for both models are provided in Table 4. The critical success factors were shown to be statistically significant at the 5% level in determining learning outcome and student satisfaction in both models. However, when compared to its effect on student satisfaction, the standardised beta for critical success factors has a higher coefficient (0.615) in causing learning outcomes (standardized beta is 0.458). It demonstrates critical e-learning success factors. The study had 37.9% explanatory power to explain student learning outcomes and 21% explanatory power to explain student happiness.

Table 4. Results of second order structural equation modelling

Dependent Variable	Independent Variable	Estimates	S.E	p-value	R-Square
LO (Learning Outcome)	Factors (CSF of e-learning)	0.615	0.205	0.000	0.379
SS (Students' Satisfaction)	Factors (CSF of e-learning)	0.458	0.115	0.000	0.210

Source: Author's compilation

As indicated by the preceding structural equation models and results in Table 5, critical success factors of e-learning are statistically significant and affect students' perceived learning outcome and satisfaction. However, the five constructs of the CSF of e-learning are not all equally important. For the first model of the study, the impact of critical e-learning success elements (named as Factors) on perceived learning outcomes. The standardised regression coefficients for all five constructs of essential success factors were found to be significant, as shown in Table 5. However, with a regression value of 0.594, the dialogue between students and instructors was shown to be the most significant, followed by student motivation with a significant regression coefficient of 0.589. It shows that good and constructive dialogue between students and between students and instructors has a large and beneficial impact on learning outcomes. In addition, according to the statistics, the instructor has an equally essential influence. Furthermore, the course aim and method for an online class, the module structure, the course content supplied to students, and the design of grading components are all critical. All of these are elements of course design, and the fourth major driver of critical success factor was discovered to have a regression weight of 0.537. The last significant determinant of critical success factor, i.e., self-regulation although found significant but least important construct among five constructs of critical success factors. The regression weight of this construct is 0.423.

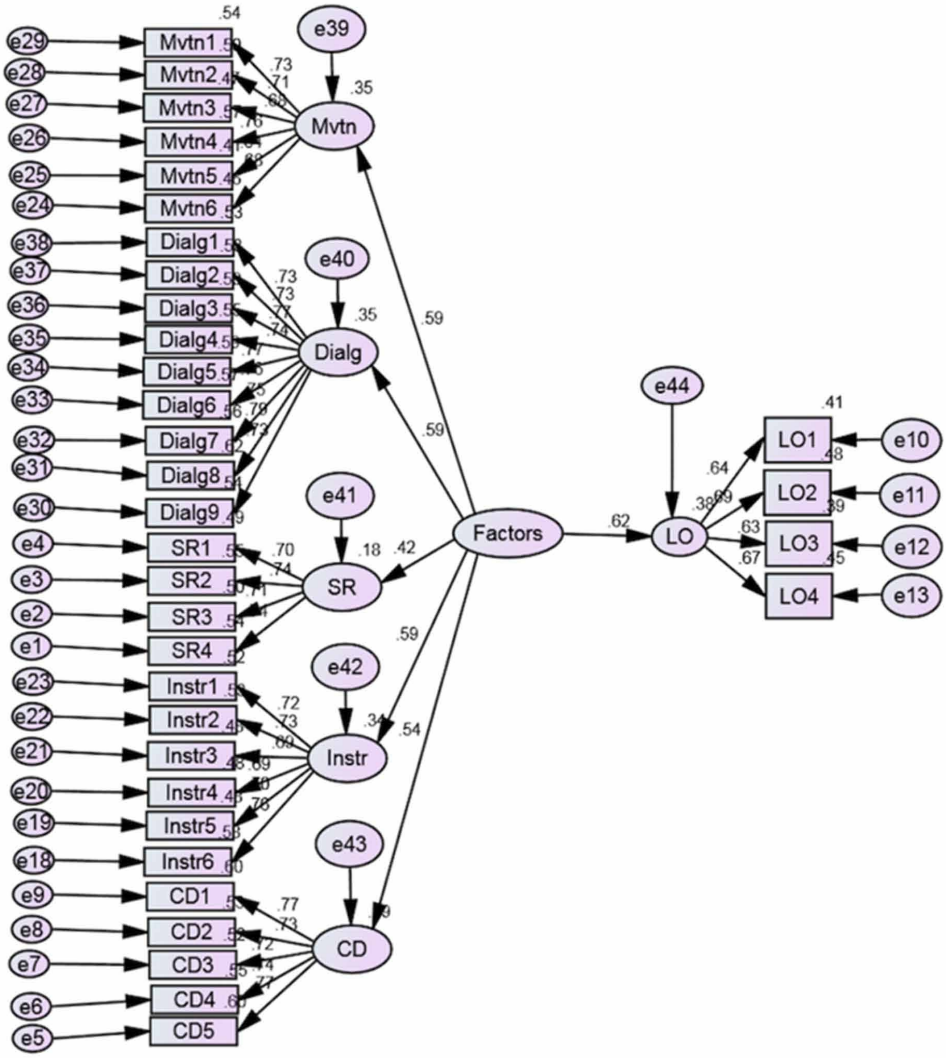
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Table 5. Regression weights of five constructs of Critical Success Factors of e-learning for Model 1

Independent Variable	Estimates	p-value
Student Motivation	0.589	0.000
Dialogue between student and student and student and instructor	0.594	0.000
Self-Regulation	0.423	0.000
Instructor	0.586	0.000
Course Design/Structure	0.537	0.000

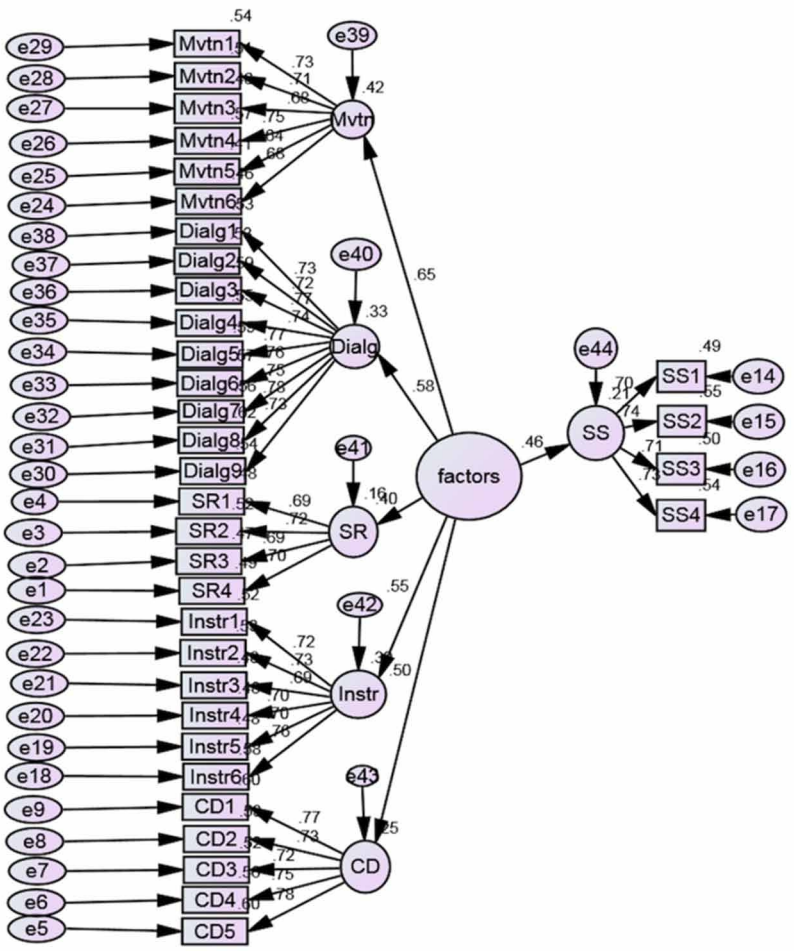
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Figure 4. Second Order Structural Model of Relationship between determinants and its effect on perceived learning outcome



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Figure 5. Second Order Structural Model of Relationship between determinants and its effect on Students' Satisfaction



Similarly, the results of the second model of the study, namely, the impact of critical success factors of e-learning (referred to as Factors) on student satisfaction, were shown to be statistically significant(see Table 6). Furthermore, similar with the previous model, model 2 of the study has five constructs of critical success factors. All five constructs exhibit statistically significant regression coefficients, suggesting that they are all relevant. However, the regression weights of these five constructs are not the same. It implies that the relative relevance of these five constructs varies. The most significant construct among five determinants of crucial success factors affecting the satisfaction of students opting for online GMAT tutoring is determined to be student motivation. This was found to have a regression coefficient of 0.648. The discovered dialogue among students and instructor was the second significant construct. This construct's regression coefficient was determined to be 0.578. For both study models, the dialogue between students & student and between students & instructors has been found to be substantially more important. The third essential construct was recognised as the instructor. Instructor significance is represented by a regression coefficient of 0.550. Furthermore, the course objective and approach for an online class, the module structure, the course material supplied to students, and the design of grading components

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are all critical. All of these are elements of course design, and the fourth major driver of crucial success factor was discovered to have a regression weight of 0.497. Self-regulation is the last noteworthy determinant of critical success factor for model two of the study. Although student self-regulation was shown to be significant, it was found to be the least relevant component of the five. This construct has a regression weight of 0.397.

Table 6. Regression weights of five constructs of critical success factors of e-learning for model 2

Independent Variable	Estimates	p-value
Student Motivation	0.648	0.000
Dialogue between student and student and student and instructor	0.578	0.000
Self-Regulation	0.397	0.000
Instructor	0.550	0.000
Course Design/Structure	0.497	0.000

Source: Author's compilation

CONCLUSION

Recommendations and Implications of the Study

The findings of the study have practical implications for a wide range of e-learning stakeholders, including educators, managers, and policymakers. The instructor and course design, according to results, are the top/major determinants of learning result and student satisfaction. As a result, these two variables should take precedence over others like conversations, motivation, and self-regulation while creating e-learning courses. To improve performance, instructional programmes that educate teachers how to continually improve their knowledge and abilities must be established. Course design should be given a lot of attention since it has such a large influence on learning outcomes. Courses in an e-learning system should be created effectively to increase learning results and student satisfaction. E-learning product development teams should give course design and instructor (among all the CSFs impacting learners' perceived learning result and student happiness) enough weight so that student satisfaction and learning outcome may be enhanced. The top 3 factors that have highest influence on Learning Outcome and Student Satisfaction are listed:

Table 7. Top three factors in both the models

	Learning Outcome	Student Satisfaction
Students Perspective	Dialogue Student Motivation Instructor	Student Motivation Dialogue Instructor

Source: Author's compilation

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Every person's life will be affected by online education in the near future, and we need to be ready for the changes. It's no longer a choice; it's a need. Obviously, things change throughout time. Over the years, a growing number of eLearning approaches have been developed. Keeping up with the ever-changing technological landscape is a continual challenge for businesses. Therefore, their continuous study will help e-learning providers in designing their products in a better way. A significant amount of capital is being spent in a number of EdTech businesses for the purpose of course design, gamification, and technological advancement. Even if many things have changed, it is essential to remember that, according to the table that was just shown, the Instructor is the most important element of all the variables. In order to improve student experience, retention rates, and learning outcomes, EdTech companies and governments need to make investments in the professional development of trainers and teachers who possess the appropriate skill sets. Training programs should be thought by the learning organizations and instructors should be hired with the right skill for students to achieve outcomes.

Limitations and Direction for Further Research

The current study, conducted in the context of a graduate admission exam, contributes to our understanding of the factors influencing student satisfaction and perceived learning outcome. It has various suggestions for future research. The first is that an e-learning system is dynamic, and this study did not look at different structures inside it. As a result, they should be researched more in the future. Because it is dependent on survey techniques, the current study has limitations in terms of survey processes/methodologies too. Future research might concentrate on the several antecedents of a single aspect, such as motivation and self-regulation, and use these antecedents as a mediating impact to investigate the learner's reported learning outcome and satisfaction (Meese, Anderman, & Anderman, 2006). Furthermore, because it includes diverse learning processes such as meta-cognition and effort regulation, the self-regulation construct can be applied in a variety of ways. As a result, these tactics can be explored in different ways in future study because they have diverse effects on learning outcomes (Broadbent and Poon, 2015). After India's new guidelines come into effect in 2020, it's safe to predict that online learning and education would be the standard rather than the exception. However, there are going to be a lot of hurdles to overcome.

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KEY TERMS AND DEFINITIONS

Common Aptitude Test: CAT a popular and rigorous entrance exam for management schools in India, went online. It was developed like the GMAT (Graduate Management Aptitude Test) and the GRE (Graduate Record Examination).

Constructivist Model: It is an important learning theory used by educators and it posits that humans actively create their own knowledge, and that learning experiences shape reality.

E-Learning: E-learning is a formalized education approach that uses electronic resources. Put differently, the distribution of education to a large number of receivers at the same or various times is known as e-learning.

Exploratory Factor Analysis: EFA is a statistical tool for discovering the underlying structure of a large set of variables. It's a method of factor analysis that seeks to uncover hidden correlations between data.

Learning Management System: LMS, as the name indicates, is an online classroom in which teachers and students can communicate with each other without having to meet face-to-face in a classroom using this sort of technology.

Purposive Sampling: It is a non-probability sampling technique in which "components chosen for the sample are picked based on the researcher's judgement."

Questionnaire: A questionnaire is a research instrument having set of questions used to collect data from respondents. These are a type of written interview and can be done in person, via phone, computer, or mail.

Structure Equation Modeling: It is a collection of statistical techniques for measuring and analyzing observed-latent relationships. It explores linear causal links between variables while accounting for measurement error.

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Section 2

Investigating the “Where” in Digital Transformation

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Chapter 5
A Fresh Look on Determinants of Online Repurchase Intention

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ABSTRACT

The e-commerce industry is continuously evolving and attained exponential growth as a result of the COVID 19-pandemic and the consequent lockdown. This has also generated possible changes in online consumer preferences. Although several studies have identified factors affecting online repurchase intention (ORI), a fresh look is required to identify key determinants of ORI. Thus, the current study, through extensive literature review, proposes and investigates such ORI determinants. Explanatory design with quantitative research method is used, and empirical data is collected using a self-administered e-questionnaire. A sample of 243 responses were collected from online consumers using snowball sampling. The data were then analyzed using AMOS 24 through series of statistical analysis. The findings show that web quality, service quality, credibility are key determinants of online repurchase intension. Electronic word of mouth (E-WoM) and customer relationship management (CRM) demonstrated insignificant impact on ORI. The results also identify perceived web quality as a factor with strongest impact on ORI.

INTRODUCTION

Over the period of last decade, electronic commerce (E-Commerce) has gained irreplaceable place in international retail framework. The advent of Internet transformed retail industry like any other sector in recent past. Nevertheless, ongoing fourth industrial revolution and digitization of the economy, consumers have well adopted online shopping and enjoying various perks of the same (Dastane, 2020).

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Worldwide, there are 4.66 billion internet users and around 2.14 billion people purchases goods online globally. Out of all the retail purchase occasions, 63% shopping occasions begin online. This sales growth is estimated to continue to rise and take up more of a retail share. According to (Statista, 2020), online sales is estimated to reach 6.40 trillion attributing to 21.8% of total retail sales by 2022.

This growth comes with several challenges and issues. The exponential growth has produced tremendous competition as several stalwarts' retailers have rallied in this sector with their e-stores and mobile apps. Such a high competition has thinner the boundaries of innovation and resulted in difficulties in offering unique value propositions. High competition also results in high switching rate as well as low engagement with prospects (Hui, Dastane, Johari & Roslee, 2020). This then generates need to think on fostering loyalty among existing customers by encouraging repurchase intentions among them. E-commerce industry is struggling with conversion rate, and it is estimated that 62% of visitors will just search products and do not make the purchases (Statista, 2019). On one hand, it is challenging to get new consumers, at the same time, according to (KPMG, 2019), it can cost 5 times more to acquire new than retaining existing one. The success rate if selling products to existing loyal customers is around 60% compared to 5-20% for that for new customers. It then becomes of paramount interest for E-Commerce players, to understand key determinants of ORI.

A number of studies have investigated the concept of repurchase intention (see. Ali & Bhasin, 2019; Bulut, 2015; Edward & Lawler, 2001; Oliver, 1980) and attributed it as a phenomenon mainly resultant of satisfaction (Cheng & lee, 2011; Ibzan, Balarabe, & Jakada, 2016; Sharma, 2017), brand (Aslam, Ham, & Farhat, 2018) and trust (Barnes, 2007; Benazić, & Tanković, 2015; Tirtayani & Sukaatmadja, 2018). However, several other studies have confirmed that repurchase is not a phenomenon limited to single factor such as satisfaction (see. Bauer, Falk, & Hammerschmidt, 2006; Phuong & Dat, 2017). There can be several influences, mediators and moderators determining repurchase intentions (Tran, Pham, & Le, 2018). For example, adjusted expectations are analyzed in reference to the new paradigm of post-consumption (Ha et al., 2010). This is particularly in the context of online shopping whereby in post-consumption the adjusted expectations of online shoppers will guide purchase behavior in the next period (Yi and La, 2004). It is then imperative to analysis various such determinants in online context. Prior literature has identified range of aspects influencing ORI (see. Bhattacherjee, 2001; Pavlou, 2003). However, several factors need to be analyzed as a result of contemporary impacts, issues and recovery post COVID 19 pandemic which significantly influenced online consumer behavior (Sheth, 2020).

Consumer habits are continuously evolving and antecedents of repurchase intention requires continuous rethinking and reinvestigation. This is more critical in E-Commerce context as a result of recent COVID 19 pandemic, subsequent lockdowns and ultimately shift in consumer behavior in several aspects. Surge in E-Commerce and acceleration in digital transformation is witnessed as result of COVID 19 amid economic slowdowns. As lockdowns became the new normal, businesses and consumers increasingly "went digital", providing and purchasing more goods and services online, raising E-Commerce's share of global retail trade from 14% in 2019 to about 17% in 2020 (Statista, 2020). Over 2 billion people purchased good online and E-Commerce revenue surpassed $ 4.2 trillion worldwide during 2020 (Statista, 2020). Notably, shift have been observed in consumer purchase trend from traditional online purchases such as apparels, electronic goods, travel products to range of new daily routine purchases such as groceries, food, daily consumables etc. Consumers not only initiated but made such unconventional purchases as routine. It is then imperative to see a fresh look on determinants of ORI in this context.

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The present study aims to review all factors present in existing literature which possibly impact ORI. The study then aims to synthesize such factors and provide a fresh look on determinants of ORI. Finally, the study intends to investigate impact of such proposed factors on ORI.

LITERATURE REVIEW

Theoretical Background

Expectation confirmation theory developed by Oliver (1980), perhaps first to underpin factors affecting repurchase intention in traditional, in-store business context. The theory got its roots in psychology and marketing literature in late 1980s. The theory highlighted that when consumers expectations get fulfilled and after a confirmation of receipts of the same in reality, consumers get satisfied, and it results in repeat purchases of the products or brands. In the field of repurchase intention and customer satisfaction, the theory has been very important as it tries to seek the explanation of post purchase or post adoption satisfaction of a product or service as a function of expectations. It is a cognitive theory which implicates satisfaction, disconfirmation of beliefs, perceived performance, and expectation. Thus, the theory has been adopted by several researchers and scientists in the field of consumer research and information system (Joo, Park, & Shin, 2017; Oghuma, et al., 2016).

Lawler (2001) added critical aspect of trust in addition to satisfaction in order to enhance relationship commitment which is prerequisite of repurchase intention. The named it as Social Exchange Theory having its ground in psychology and sociology based on understanding social behavior on the interaction of two parties from the perspective of implementing the cost-benefit analysis leading to determine the risks and benefits of the relationship. Thus, that context tries to know exactly how social interaction in marketing can help drive repurchase intention because the social exchange theory says that if the costs of the relationship are higher than the rewards, such as if a lot of effort or money were put into a relationship and not reciprocated, then the relationship may be terminated or abandoned. Thus, the basic concept of the theory is based on knowing how a social behavior might result both in social outcomes and economic outcomes, this is generally analyzed by comparing human interactions with the marketplace (Hsiao, Chang, & Tang, 2016).

A foray of researchers then developed research models based on foundation of such theories and tested for various industries both in traditional business context (see. Fook & Dastane, 2021) as well as E-Commerce context (see. Ali & Bhasin, 2019; Benazić & Tanković, 2015; Bulut, 2015). Apart from trust and satisfaction as a factor, several important factors affecting repurchase intention were confirmed such as brand association (Arif, 2019; Aslam, Ham, & Farhat, 2018), customer perceived value (Haba & Dastane, 2018), relationship management. etc. We have summarized such empirical studies from recent past and extracted various elements affecting ORI as in following section.

Determinants of ORI

Table 1 summarizes key factors affecting ORI investigated and confirmed by various authors since past five years. The studies are specifically related to E-Commerce context.

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Table 1. Key factors affecting ORI available in extant literature

Author (s)	Factors affecting ORI	Study Location
Lukitoa and Ikhsan (2020)	Perceived Risk, Perceived Usefulness	Indonesia
Park & Thangam (2019)	Customer Trust, Loyalty, And Satisfaction	Korea
Trivedi & Yadav (2018)	Trust, Security Concerns, Privacy Concerns	India
Santoso (2019)	Perceived System Quality, Perceived Information Quality, Perceived Service Quality, Subjective Norm, Perceived Price, Online Shopper's Trust, Online Shopper's Satisfaction.	Indonesia
Farida & Ardyan (2018)	Website Quality, Customer Satisfaction	Indonesia
Shihab, Maulana & Hidayanto (2018)	Perceived Value, Trust, Satisfaction	Indonesia
Sullivan & Kim (2018)	Perceived Risk, PU, Trust, Website Reputation, Product Quality, Perceived Value	USA
Lim, Cheng-Xi &Teoh (2018)	Effort Expectancy, Performance Expectancy, Self-Efficacy, Trust	Malaysia
Pham, Tran, Misra, Maskeliunas & Damaševi˘cius (2018)	Convenience, Perceived Value	Vietnam
Ifinedo (2018)	Perceived Ease of Use, Perceived Usefulness, Perceived Compatibility, Perceived Support for Enhancing Social Ties, Perceived Self-Efficacy, Attitude Toward Blog, Perceived Impact on Learning, Satisfaction	NA
Husain (2017)	Design, Assortment, Perceived Value, Security, Fulfillment	India
Joo et al. (2017)	Expectation, Perceived Enjoyment, Perceived Usefulness, Satisfaction	NA
Suhaily & Soelasih (2017)	E-Service Quality, Price Perception, Experiential Marketing, Customer Satisfaction	Indonesia
Oghuma et al. (2016)	Service Quality, Confirmation, Perceived Usefulness, Perceived Enjoyment, User Interface, Security, Satisfaction	NA
Hsiao et al. (2016)	Perceived Usefulness, Perceived Enjoyment, Social Ties, Satisfaction, Habit	NA
Bulut (2015)	E-Satisfaction, E-Trust and E-Loyalty	Turkish Consumers

Key factors identified by several authors include perceived ease of use, perceived usefulness, perceived support for enhancing social ties, perceived self-efficacy, learning of repurchase intention, customer convenience and customer satisfaction in different industries of the modern economy and ORI from different countries (Ifinedo, 2018; Pham et al, 2018; Lim et al, 2018; Sullivan & Kim, 2018; Shihab et al, 2018; Farida & Ardyan, 2018). Nevertheless, lately there had been some supportive studies in the field of repurchase intention and customer satisfaction in academic contribution in 2019 in different countries such as the study of Ashfaq et al (2019) in China based on perceive enjoyment and perceived ease of use, the study of Santoso (2019) in Indonesia based on perceived quality, shopper's trust, online shopper's satisfaction, perceived system quality and ORI, the findings were supported by Lukitoa and Ikhsan (2020) on perceived risk and usefulness in Indonesia. The study of Park and Thangam (2019) based on customer satisfaction, loyalty and trust by integrating technological factors. Trivedi & Yadav (2018) did a study in India based on the repurchase intention on factors which can impact the customer confidence of online payment such as security and privacy concerns.

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Ali & Bhasin (2019) investigated the role of perceived price, delivery quality and perceived value to understand repurchase intention. The model of their study was tested using data collected through online survey in India with a total sample size of 314 respondents. The findings of this study portray that perceived price and delivery quality have significant impact on perceived value, and perceived value has significant impact on repurchase intention. Johan et al (2020) measured repurchase intention on Fashion online shopping website in Surabaya, with a sample of 115 participants based on quantitative research method, the research used partial least square (PLS) method for data analysis, the result of the analysis demonstrated that hat e-service convenience has a significant impact on customer satisfaction, customer satisfaction has a significant impact on repurchase intention, e-service convenience has a significant impact on repurchase intention, and perceived value has a significant impact on repurchase intention. ILYAS et al (2020), based on reflective model of brand awareness on repurchase intention and customer satisfaction, had used variables such as recall, consumption and purchase intention. With a primary data collection method and a sample size of 200 participants. The researchers used structural equation modelling (SEM) to attain the objectives of the research. Through indirect relationship, namely, brand awareness on repurchase intention through customer satisfaction, the study showed no significant effect. In a comprehensive way, this study emphasizes the factor of customer satisfaction as a determinant of consumer loyalty and repurchase intention. Therefore, creating optimal customer satisfaction, service excellence, promotion, and massive advertising, guaranteeing the safety and ease-of-use apps, and ease of shopping, especially for E-Commerce industry, is a serious concern.

Although several studies have investigated various factors affecting ORI, there is no consensus on key determinants of ORI for the evolved consumer behaviors in the context of in the contemporary issues. The gap is identified when it comes to drafting a construct or constructs which encompasses all possible factors affecting ORI. This omission is addressed by considering fresh re-grouping of determinants of ORI.

A Fresh Look on ORI Determinants

Against aforementioned background, problem statement and stated research gap, the current study proposes five main constructs derived from all major key determinants of ORI investigated in the past and identified as outcome of extensive literature review. The groping of various related elements under constructs is as displayed in table 2 and elaborated further in hypothesis development section:

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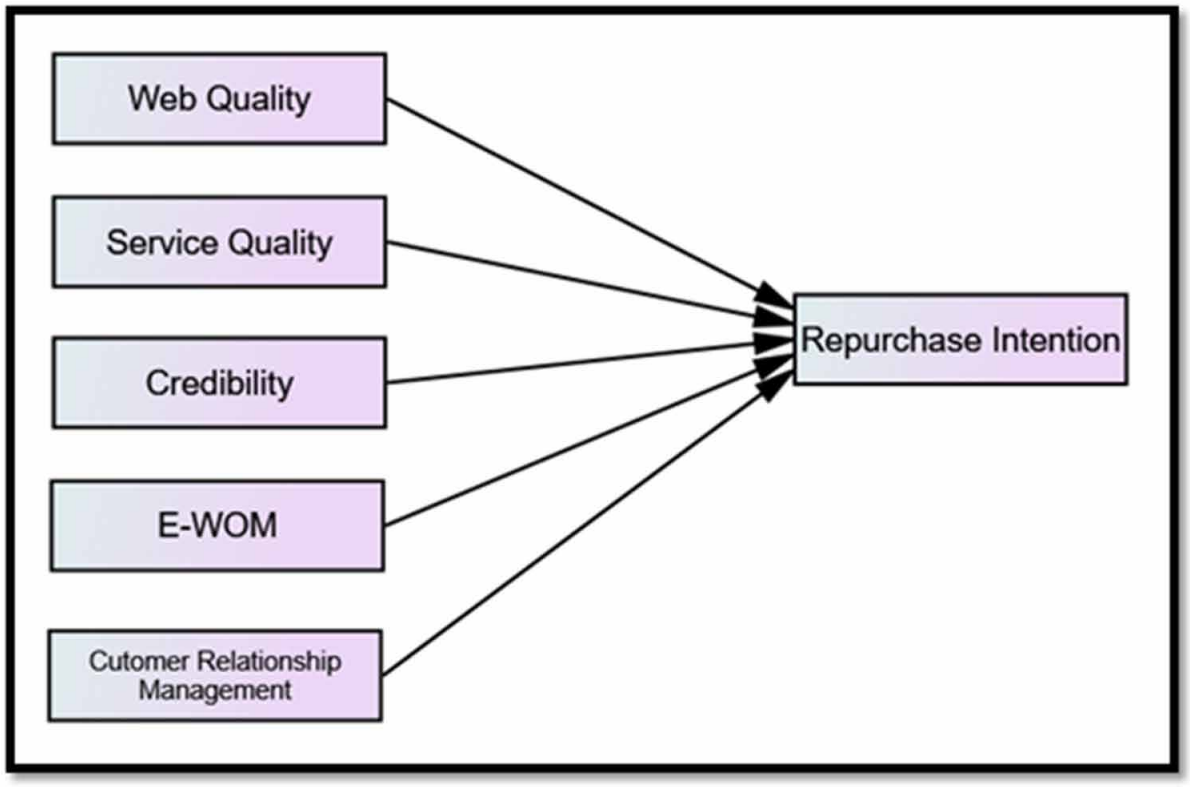
Table 2. Determinants of ORI

Proposed Determinants	Factors	Source
Web Quality	System Quality	Semuel, Wijaya & Devie (2019) Sien & Falahat, (2015)
	Information Quality	
	PU	
	PEOU	
	Perceived Value	
	Perceived Enjoyment	
	Expectation,	
	Perceived Compatibility (PC)	
	Confirmation (CON)	
	User Interface (UI)	
	Website Quality (WQ)	
Service Quality	Service Quality	Kalia, Arora & Kumalo, (2016); Rita, Oliveira & Farisa, (2019)
	Service Recovery	
Credibility	Security	Semuel et al. (2019), Kalia et al. (2016); Sien & Falahat, (2015)
	Privacy,	
	Non-Deception,	
	Fulfilment/ Reliability,	
	Perceived Risk,	
	Firm's Reputation	
	E-Trust	
E-WoM	E-Word of Mouth	
CRM	Online Shopping Experience (OSE)	Rita et al., (2019)

Following conceptual model as displayed in figure 1is thus proposed which comprises all those factors which may determine ORI.

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Figure 1. Conceptual Model



Hypothesis Development

Website quality alludes to internet shopper's view of the general nature of a website (Hsu & Tsou, 2017) and it can significantly affect website utilization. In an E-Commerce, website assumes a critical job in drawing in, continuing, and holding the enthusiasm of a purchaser at a webpage (Razak, Ahmad & Marimuthu 2016). Website quality is a site's apparent quality by clients and would expand fulfillment with the site, trust on the website. Based on Razak et al. (2016), it is accepted that shoppers are bound to visit; buy and repurchase from well-structured online stores. Nor Azureen et. al, (2014) suggested that a significant highlight in an effective web architecture is neat appearance, navigation, and a well-sorted content. DeLone and McLean, (2004) argues that site quality must be estimated from the customer's perspective by isolating data quality, framework quality, and administration quality and furthermore this point of view gives a hypothetical support to considering site quality as a higher-request build driven by these three essential elements. In this context Ganguly et al (2010) argues that when clients collaborate with an online store, they like to do so by means of a specialized interface and not through any employee. In this manner the structure of the website, which goes about as the interface, would assume a critical job in impacting consumer loyalty. In a few research endeavors to look at website quality, the idea of website quality was at first constrained to ease of use. Analysts estimated client fulfillment against the plan of web interface with conventional convenience assessment estimations, for example, allure, control, proficiency, influence and learnability (Kuan, Bock & Vathanophas, 2008). Web site quality has a

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positive significant impact on repurchase expectation (Razak et al., 2016). In this manner, the client's view of administration quality and fulfillment with the administration has a positive effect altogether on the eagerness to purchase later (Moeeini & Fard, 2014). Thus, the first hypothesis proposed as follows:

- **H1:** Web Quality positively and significantly impacts ORI

Service quality as the clients' general judgment of the greatness of service offering (Sharma, 2017). The conceptualization of administration quality has its establishments in the expectation disconfirmation hypothesis, there is an indication that the appraisal of administration quality results from differentiating the perspective on administration got with earlier desire for what the service ought to give (Sheng, Yeen, Luen & Peng, 2018). Service quality is progressively being perceived as a basic element of Web shopping administration quality, influencing a client's impression of shopping esteem, just as fulfillment and repurchase goal (Kim et al., 2012). According to Lee & Lin, (2005) due to the particular traits of on-line shopping, the conceptualization and size of e-service high-quality encompasses the two facets of client services and records systems and consists of all elements associated with the procedure of service shipping (Cheng et al., 2013). It was advised a multiple-item scale consisted of four perceived e service pleasant dimensions; internet design, customer service, guarantee and order control (Baykal, 2015). Past research has demonstrated that expeditious item conveyance and simplicity of item return altogether increment a shopper's certain encounters, including more noteworthy happiness and enjoyment just as fruition of their primary target of buying an item on the web (Ha and Stoel, 2009). Thusly, second hypothesis formulated as follows:

- **H2:** Service Quality positively and significantly impacts ORI

Numerous investigations have been conducted to look at the impact of apparent risks on shopping intension (Folarin & Ogundare, 2016). There are two hypothetical points of view about shopping risk. First is fixated on a choice outcome's vulnerability and another focused on the expenses or outcomes of such outcomes (Masoud, 2013; Hong, Zulkiffli & Hamsani, 2016). Contrasting and customary method for shopping, web-based shopping apparent to have higher risks. Barnes, (2007) mentioned that perceived risk decreases the readiness of buyers to buy great or administration on the web and Pavlou, (2003) agrees that online customers are reluctant to endure misfortunes when what they expect isn't the equivalent with the truth (Tanadi, Samadi & Gharleghi, 2015). Risk mirrors client's emotional conviction about the likelihood of a negative result from any buy choices as far as practical hazard, physical hazard, money related hazard, social hazard, mental hazard or time chance (Sharma & Sitlani, 2013). Perceived risk can be defined as "patron's doubt about the end result of their decisions" (Tho, Lai & Yan, 2017). Hence, it is diagnosed that threat perceptions at once affect purchasing and purchase purpose: when customers' perceived risk is high, the opportunity of a purchaser to buy or to repurchase online could be low (Benazić, Tanković, 2015). The more chance consumer perceives, the less probable it's far that they may make a purchase (Zhang et al., 2012); due to the fact the fact that "purchasers are greater frequently encouraged to keep away from mistakes than to maximize utility in shopping" (Mitchell, 1999). We have reverse coded this aspect of perceived list whereby credibility minimizes the perception of risk. Thusly, third hypothesis proposed that,

- **H3:** Credibility positively and significantly impacts ORI

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CRM is connected to attracting, keeping up and holding beneficial customers over indistinct time period. (Dastane, 2020). CRM is a system for understanding the customer directly through outrageous correspondence with him/her and execution, which is addressed in attracting the customer, keeping him/her and growing his/her commitment and advantage (Kumar, 2012). In the online state of affairs wherein face-to-face interaction is limited, agencies will therefore look for opportunity to put in force CRM (Cheng & Lee, 2011). CRM turn out to be the corporate strategic and equipment for enhancing the company productiveness and upholding their courting with their clients as well. Roushdy and Ali, (2017) uncovered that CRM emphatically impacts repurchase intention. The effect of client commitment on clients' repurchase aim was worried by Pham et al. (2018) who investigated an assortment of looks into under this theme and proposed that there are two viewpoints of its clarification, the primary viewpoint is from the pragmatic perspective which characterize client commitment as a gathering of exercises improving repurchase conduct and fortifying client relationship and promise to an organization, and the subsequent point of view is from the scholarly perspective which consider client commitment as a proportion of intensity of client association with an organization in a shared information trade process (Roushdy and Ali, 2017). Thusly, fourth hypothesis formulated as,

- **H4:** CRM positively and significantly impacts ORI

Kotler et. al (2014) defines word-of-mouth as "individuals to-individuals oral, composed, or electronic interchanges that identify with the benefits or encounters of buying or utilizing items or services". E-WoM can also be described as sharing of data about item and services among individuals who connect with each other in virtual universe of social media (Sulthana & Vasantha, (2019). According to Hennig et al. (2004) e-WOM is principally founded on the casual correspondence among buyers utilizing the different online media to examine the positive or negative attributes of any merchandise or benefits, or even the makers or merchants. E-WOM is commonly viewed as favorable in light of the fact that it is effectively accessible and open to any individual who can utilize the Internet. Hennig et al. (2004) stresses that the web gives an ideal mix of user socioeconomics, which empowers buyers to peruse a blend of suppositions that assist them with shaping their own feelings about an item or service (Sulthana & Vasantha, 2019). With the presentation of web 2.0 innovation, eWOM essentially affects customers' buy aims, since they trust on eWOM before making any item buy (Tho, Lai, & Yan, 2017). Arif (2019) supports that eWOM influences customer's repurchase intention. An exploratory examination directed by Keaveney and Parthasarathy (2001) showed eWoM decidedly builds repurchase intention (Liang, Choi & Joppe, 2015). Thus, fifth hypothesis is formulated as,

- **H5:** E-WoM positively and significantly impacts ORI

RESEARCH METHODOLOGY

The research employs explanatory research design in order to investigate causal relationship between dependent and independent variables. Quantitative research method is used by collecting empirical data using self-administered, online questionnaire measuring items on Likert scale of 1 (strongly disagree) to 7 (strongly agree). Research population involves Malaysian internet users who are buying products online. No-probability snowball sampling technique is used to select survey respondents. All partakers

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are welcome to take part. As long as the participant is within the age of 18 years old and above regardless of gender, occupation and monthly income are allowed to participate. Past researchers used assessment measure in the middle of 100 to 500 respondents (Kothari, 2004). A rule of thumb-of-5 approach for pattern selection is embraced (30 items multiply with 5) that is minimal of 150 samples which fit as sampling population (Hair et al., 2010). For this survey, questionnaire was distributed electronically via a link provided through social media to invite more respondent to contribute in the survey. Sample composition include individuals who are online shoppers (internet users) and therefore fully understand the nature of online shopping.

The questionnaire is split into two parts. The first part includes questions related to participants demographic characteristics which includes, age, gender, education level, occupation, and income. The second part related to the questions to acquire records touching on participant's opinion primarily based at the diagnosed variables. The questionnaire was designed based on six variables: perceived web quality, E-WoM, perceived service quality, perceived risk, CRM and Re-purchase intention. Table 3 shows survey questionnaire items.

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Table 3. Questionnaire items

Variables	Adapted Items	Ref/Sources
Web Quality	This online website functions smoothly	Shergill & Chen, (2005); Semuel et al. (2019)
	This online shopping website has very attractive colours	
	This online shopping website uses proper font sizes	
	The information regarding the product sold clearly presented on this website	
	The website helps in assessment and comparison of products	
E-WoM	I read other people reviews before making purchase	
	I am influenced by social media to purchase from this website.	
	The high recommendation of the website influences my purchasing decision	
	The more the website is discussed in in front of me the more it influences my purchasing decisions	
	The overall rankings of a product/item on the website helps me to make my purchasing decision easier	
Service Quality	This website has no issues related to delivery on time	Kalia et al. (2016); Rita et al., (2019)
	The website is prompt in responding to my queries	
	The quantity of products received on this website the same as my order	
	The quality of products received on this website the same as my order	
	The website provides me with convenient options for returning items/products	
Credibility	My privacy is protected at this website	Semuel et al. (2019), Shergill & Chen, (2005) Kalia et al, (2016); Sien, (2015)
	It is safe to perform transactions with this website	
	Products in this website are authentic	
	Risk associated with online transaction on this website is low	
	This website protects my billing information	
CRM	The website sends frequent updates on latest product/items	Rita et al., (2019)
	The website frequently sends special promotions	
	The website gives awareness about the product/items	
	The website provides customer service representatives available Online	
	The website has online feedback feature available for after sales product review	
ORI	I intend to buy from this online shopping website again	Kim et al., (2012); Bulut, (2015); Sharma &
	I will use this online shopping website frequently	
	My future purchase will be from this website as well	
	I consider the website my first choice when buying products from online retailers	
	It is likely that I will continue to purchase products from the website in the future	

IBM SPSS 22 is used for preliminary data analysis which includes data purification, screening, normality and reliability assessment as recommended by (Hair et al., 2010). This was then followed by Confirmatory Factory Analysis (CFA), validity assessment and finally Structural Equation Modelling (SEM) using IBM SPSS AMOS 24 software. The advanced analysis follows recommendations of (Awang, 2015). Participants were well informed on the nature of research and data protection strate-

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gies. The participation was voluntary, and research followed ethical code of conduct related to Human participation Ethics.

ANALYSIS, RESULT AND DISCUSSION

Demographic Analysis

Gender, Age, Education level, Personal monthly income and occupation are included in the demographics outlines from the sample size of 243 respondents in this paper. The male respondent has a total of 149 (61.3%) and female has 94 (38.7%) respondents. In terms of age group, 28-37 years old has the higher number of respondents with 96 (39.5%) out of 243. The younger age group of 18-27 years old has 66 respondents (27.1%) and middle age group 38-47 years old with 58 respondents (23.9%). The older age group of 48 and above has only 23 respondents (9.5%). The undergraduate degree respondents are almost half of the total number of respondents with 120 (49.3%) respectively, followed by the postgraduate degree level with 61 (25.1%) and college diploma level with 49 respondents (20.1%). The primary and secondary school level is with 1% and 4.5% respectively. From the total of 243 respondents 42.4% (103) are earning more than RM 5, 001 and above. 29.6% (72 respondents) are earning between RM 3, 001 to RM 5, 000. 18 respondents (20.6%) earn between RM 2, 001 to RM 3, 500 and finally 20.6% (50) out of the total of 243 are having an income less than RM 2, 000 a month. The respondents from the private sector have a larger number with 110 (45.3%) out of the total respondents. At 17.7% (43) respondents are the students and the self-employed are with 40 (16.5%) respondents. The government sector and others are 12.3% (30) and 8.2% (20) respondents respectively.

Normality Test

Next, the data is assessed for its normal distribution. According to (Kothari, 2004), the data need to be normally distributed in order to perform further analysis. According to (Hair, et al., 2010) rule of thumb, preferably the values of kurtosis and skewness must be between -1 to +1. However, the values for symmetry and kurtosis between -2 and +2 are taken into consideration suitable if you want to show ordinary univariate distribution. Table 4 displays the result of kurtosis and skewness of the collected data. Base on the results, overall data of the normality test was good where most of the values are within the acceptable range of -2 to +2. Nevertheless, there are two values that were above the acceptable range for kurtosis which are variables WQ1 and WOM1 which will be tested using a different set of tools.

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Table 4. Normality assessment

	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
WQ1	5.498	1.2243	-1.596	.156	3.426	.311
WQ2	5.498	1.1404	-1.082	.156	1.828	.311
WQ3	5.272	1.3144	-1.162	.156	1.444	.311
WQ4	5.099	1.2979	-.780	.156	.396	.311
WQ5	4.971	1.5438	-.712	.156	-.373	.311
WOM1	5.765	1.3231	-1.493	.156	2.284	.311
WOM2	4.889	1.6032	-.703	.156	-.264	.311
WOM3	4.918	1.5486	-.629	.156	-.305	.311
WOM4	4.774	1.6966	-.475	.156	-.877	.311
WOM5	5.370	1.3090	-.879	.156	.770	.311
SQ1	4.971	1.4414	-.642	.156	-.208	.311
SQ2	4.778	1.4054	-.598	.156	-.296	.311
SQ3	5.354	1.3041	-1.029	.156	1.046	.311
SQ4	5.058	1.3715	-.599	.156	-.058	.311
SQ5	4.864	1.4778	-.693	.156	.023	.311
PR1	4.753	1.5709	-.759	.156	-.094	.311
PR2	5.095	1.3619	-1.063	.156	1.099	.311
PR3	4.691	1.4227	-.579	.156	.052	.311
PR4	4.753	1.4760	-.710	.156	-.050	.311
PR5	4.885	1.4500	-.839	.156	.283	.311
CRM1	5.292	1.3334	-1.181	.156	1.249	.311
CRM2	5.412	1.2676	-1.107	.156	1.304	.311
CRM3	4.975	1.3297	-.624	.156	.014	.311
CRM4	5.000	1.4602	-.851	.156	.417	.311
CRM5	5.296	1.2208	-.886	.156	.854	.311
RPI1	5.333	1.3330	-1.210	.156	1.461	.311
RPI2	5.267	1.3417	-.820	.156	.311	.311
RPI3	5.123	1.3427	-.919	.156	.627	.311
RPI4	5.021	1.4671	-.772	.156	.060	.311
RPI5	5.296	1.3371	-1.079	.156	1.158	.311
N						

Reliability Test

It is vital to examine the reliability in statistical evaluation at the evenness of the general records set and whether or not comparable results are produced in a steady way, then handiest the set of facts is measured to be of high reliability (Kothari, 2004). The most normally used internal consistency degree

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is the Cronbach Alpha coefficient where according (Hair et al., 2010) it observed as the most suitable measure of reliability when using the Likert scales. The table 5 below can be called the rule of thumb with Cronbach's alpha rating interpretation. The overall Cronbach's Alpha scoring was .953 from the 30 items that we tested, this indicated a remarkably high reliability and internal consistency in our scale. The E-WoM with a scoring of 0.799 which falls under the acceptable level of the Cronbach's Alpha Scoring. Perceived Web Quality, Service Quality and CRM with a scoring of 0.811, 0.855 and 0.823 respectively falls under the good level of the Cronbach's Alpha Score. The remaining 2 variables are remarkably high reliability and internal consistency with a scoring of more than 0.9.

Table 5. Reliability assessment

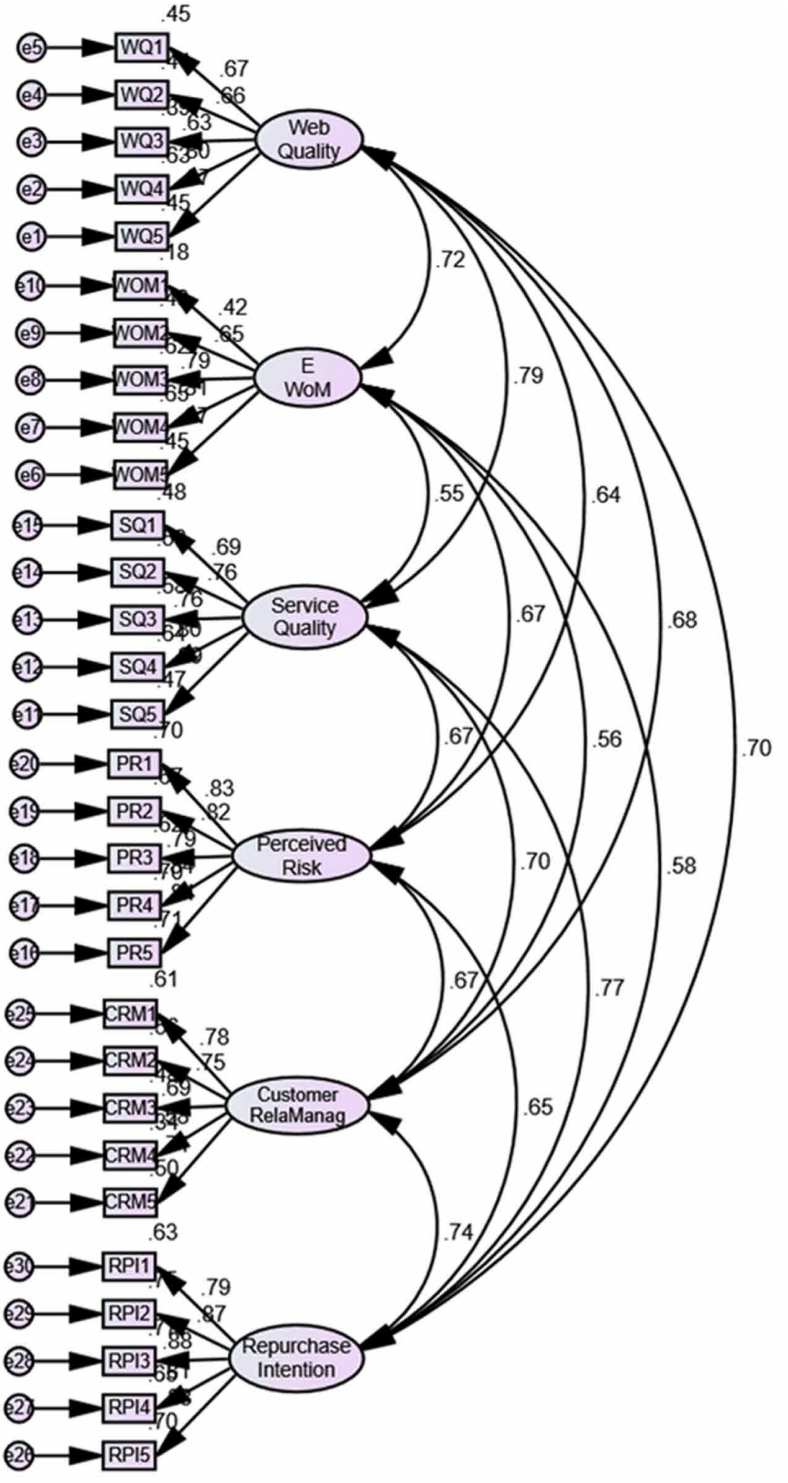
Variable	No. of Items	Cronbach's Alpha Score	Remarks
E-WoM	5	0.799	Acceptable
Perceived Web Quality	5	0.811	Good
Service Quality	5	0.855	Good
CRM	5	0.823	Good
Perceived Risk	5	.900	Excellent
ORI	5	.900	Excellent
Overall	30	.953	Excellent

Confirmatory Factor Analysis

CFA is a technique that "seeks to check if the number of factors (or constructs) and the loadings of found (indicator) variables on them conform to what's predicted on the premise of principle" (Awang, 2015). There are mainly four rational on why CFA is used namely, psychometric evaluation of methods; construct validation; testing method effect; and testing measurement invariance. For this chapter, CFA is adopted to test the proposed model fit with factors such as chi-square test, room mean square error of approximation and comparative fir index via statistical package using AMOS 24. In CFA there are few fitness indices that could affect the fitness connection between the models, therefore it is always proposed to use at least one of the indices from each category to test the model fit (Hair et al., 2014). The table 6 indicates the acceptance level of all the category of index:

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Figure 2. Initial Measurement Model



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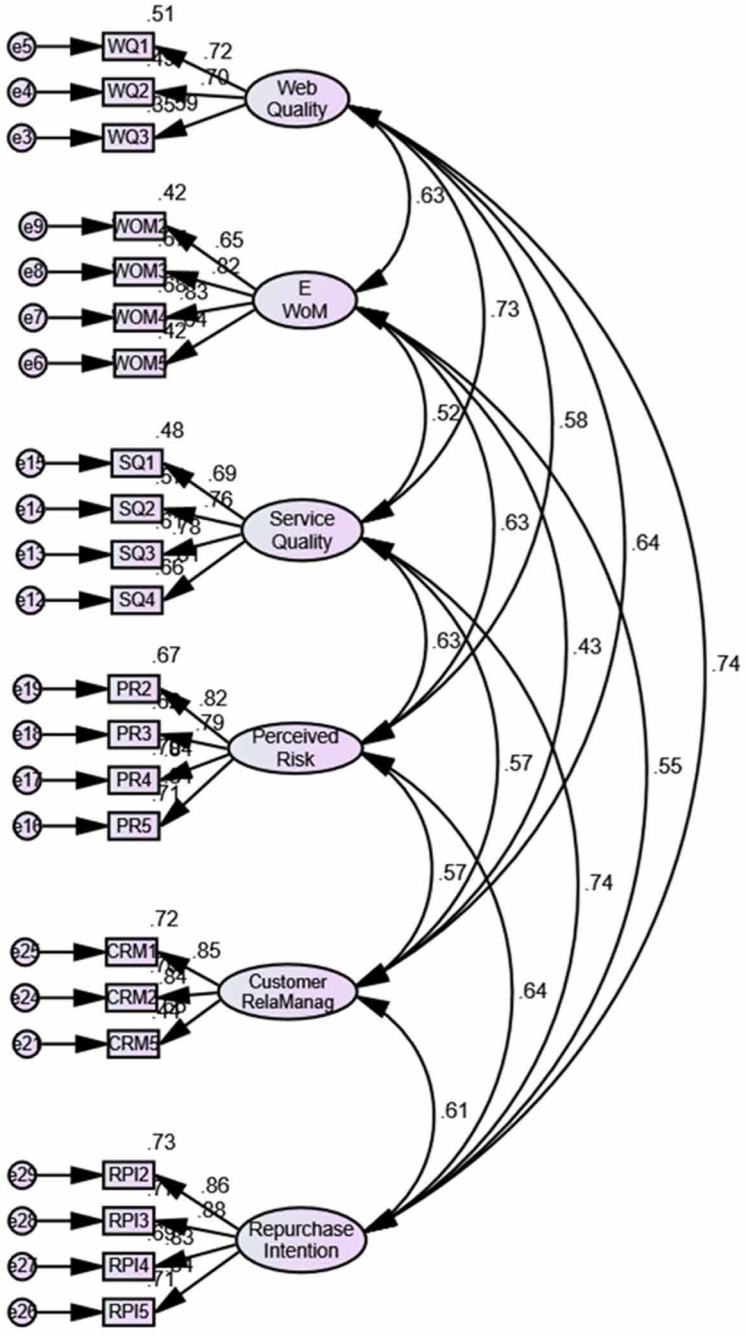
Table 6. Model fit indices (measurement model)

Category	Index	Level of Acceptance	CFA Result	Decision
Absolute Fit	Chisq	P < 0.05	0.000	Acceptable
	RMSEA	< 0.08	0.082	Not Acceptable
Incremental Fit	CFI	> 0.90	0.862	Not Acceptable
	GFI	> 0.90	0.761	Not Acceptable
	AGFI	> 0.80	0.715	Not Acceptable
	IFI	> 0.90	0.864	Not Acceptable
	TLI	> 0.90	0.847	Not Acceptable
Parsimony Fit	Chisq/df	< 5.0	2.646	Acceptable

The initial measurement model and summary of the initial model fit is shown in the Figure 2. Based on the results only the Chi-square value over degree of freedom (X^2/df) and Chi-square is between the acceptable level with 2.646 and 0.000. The CFI (Comparative Fit Index), IFI (Incremental Fit Index), TLI (Tucker-Lewis index) RMSEA (Root Mean Square Error of Approximation) are below the acceptable value of 0.90 and 0.08 respectively. To ensure the model fit, procedure suggested by Hair at al. (2010) and recommended by Awang (2015) was used as demonstrated by (Dastane & Fazlin, 2017; Donni, Dastane, Haba & Selvaraj, 2018; Keong & Dastane, 2019). The iterative procedure was followed first by deleting items with factor loading less than 0.5 and then by checking modification indices (MI). Factors with high modification indices were identified and one of the items were deleted. It was ensured that only one item is being deleted at one time. Furthermore, care has been taken to maintain minimum number of items as three per construct. Deleted items include WQ4 and WQ5 for the construct of website quality; WOM1 for the construct of E-WoM; SQ5 for the construct of service quality; CRM3 and CRM4 for the construct of CRM.

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Figure 3. Revised Measurement Model



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Table 7. Model fit indices (revised measurement model)

Category	Index	Level of Acceptance	CFA Result	Decision
Absolute Fit	Chisq	P < 0.05	0.000	Acceptable
	RMSEA	< 0.08	0.078	Acceptable
Incremental Fit	CFI	> 0.90	0.912	Acceptable
	GFI	> 0.90	0.851	Acceptable
	AGFI	> 0.80	0.807	Acceptable
	IFI	> 0.90	0.913	Acceptable
	TLI	> 0.90	0.896	Acceptable
Parsimony Fit	Chisq/df	< 5.0	2.454	Acceptable

The Final CFA Model Fit output is shown in Figure 3. The summary of the Final CFA model fit presented in table 7 shows that all indexes portray an acceptable fit for the dataset of the measurement model. A scoring of Chi-square value over degree-of-freedom of (2.454) which is below the acceptable level. The Comparative Fix Index (0.912), Incremental Fit Index (0.913) and Tucker-Lewis Index (0.896) are above or close to 0.90. The scoring of Root Mean Square Error of Approximation (0.078) is below 0.08 and finally the chi-square shows a significant value of 0.000. This research proceeds further to perform the testing of the assumption because the CFA measurement of model fit values are acceptable.

Divergent Validity

Divergent validity measurement is followed to assess the construct validity in a dimension mission. It also serves as an indication while completely specific attributes of theoretical interest do no longer appear to be correlative to a totally excessive degree, or in other words they share very little mutual variance. In the case of Divergent validity, the rule of thumb indicated that the loading factor should be more than 0.5 (Hair et al., 2014). Table 8 presents the outcome is the divergent validity. It can be seen that all the variables are above the acceptable level.

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Table 8. Divergent validity assessment

	Web Quality	Service Quality	Credibility	CRM	E-WOM	ORI
WQ1	.715					
WQ2	.699					
WQ3	.595					
SQ1		.695				
SQ2		.758				
SQ3		.779				
SQ4		.809				
PR2			.831			
PR3			.788			
PR4			.839			
PR5			.827			
CRM1				.848		
CRM2				.836		
CRM5				.665		
E-WOM2					.650	
E-WOM3					.819	
E-WOM4					.825	
E-WOM5					.645	
RPI2						.857
RPI3						.879
RPI4						.830
RPI5						.840
Reliability	0.811	0.855	0.823	0.913	0.799	0.955

Discriminant Validity

Discriminant validity is regarding the volume wherein the construct is surely differing from each other empirically. According to Hair et al. (2014) it is additionally measuring the diploma of variations between the overlapping constructs. The acceptable value should be less than 0.80 however other researchers have quote that less than 1.00 can also be an acceptable value. Table 9 displays discriminant validity results.

Table 9. Discriminant validity assessment

	CR	AVE	MSV	MaxR(H)	CRM	WQ	E_WoM	SQ	PC	RPI
CRM	0.829	0.620	0.406	0.850	**0.787**					
WQ	0.710	0.551	0.651	0.718	0.637	**0.672**				
E_WoM	0.827	0.547	0.406	0.849	0.426	0.629	**0.740**			
SQ	0.846	0.580	0.542	0.851	0.570	0.731	0.522	**0.761**		
PR	0.892	0.675	0.411	0.894	0.573	0.581	0.637	0.633	**0.821**	
RI	0.914	0.725	0.551	0.915	0.607	0.742	0.547	0.736	0.641	**0.852**

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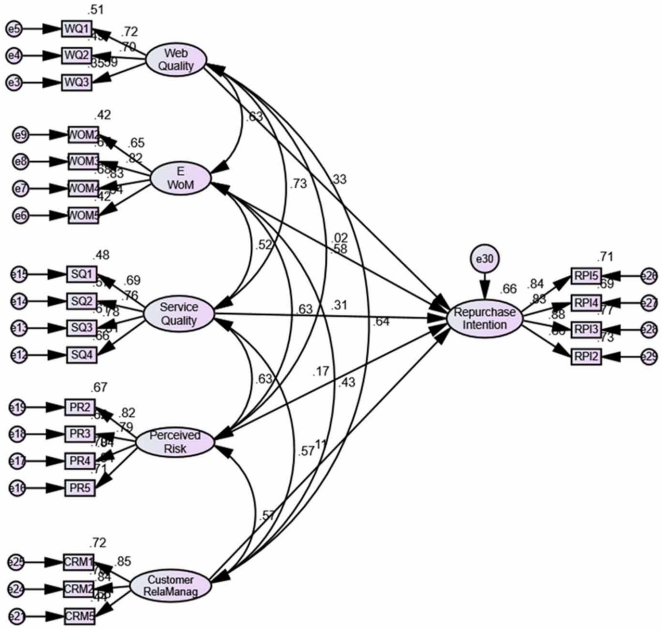
As seen all combination of values are less than 0.80 except for CRM to repurchase intention which is 0.81. As mentioned by Evan (1996), value less than 1.00 is also accepted by other researchers, based on that quote all the combinations are in the acceptable range and therefore the data fulfils the discriminant validity.

Structural Equation Modelling

Table 10. Model fit indices (structural model)

Category	Index	Level of Acceptance	CFA Result	Decision
Absolute Fit	Chisq	P < 0.05	0.000	Acceptable
	RMSEA	< 0.08	0.078	
Incremental Fit	CFI	> 0.90	0.912	
	GFI	> 0.90	0.851	
	AGFI	> 0.80	0.807	
	IFI	> 0.90	0.913	
	TLI	> 0.90	0.896	
Parsimony Fit	Chisq/df	< 5.0	2.454	

Figure 4. Structural Model



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The Figure 4 shown above is the SEM validation without mediation effect. The Chi-square value over degree-of-freedom of (2.454) which is below the acceptable level. The Comparative Fix Index (0.912), Incremental Fit Index (0.913) and Tucker-Lewis Index (0.896) are all above 0.90 which represents a good fit model (Hair et al., 2014). The scoring of Root Mean Square Error of Approximation (0.078) is below 0.08 and finally the chi-square shows a significant value of 0.000 as shown in Table 10.

Comparison of Factor Loading

In order to test the validity and accuracy of the structural model further, a comparison of factor loading between measurement model (CFA) and structural model (SEM) will be carried out.

Table 11. Factor loading comparison

Construct	Indicator	CFA (from CFA output)	SEM (from SEM output)
Perceived Web Quality	WQ1	.715	.715
	WQ2	.699	.699
	WQ3	.595	.595
Perceived Service Quality	SQ1	.695	.695
	SQ2	.758	.758
	SQ3	.779	.779
	SQ4	.809	.809
Credibility	PR2	.831	.831
	PR3	.788	.788
	PR4	.839	.839
	PR5	.827	.827
CRM	CRM1	.848	.848
	CRM2	.836	.836
	CRM5	.665	.665
E-WoM	E-WOM2	.650	.650
	E-WOM3	.819	.819
	E-WOM4	.825	.825
	E-WOM5	.645	.645
Repurchase Intention	RPI2	.857	.857
	RPI3	.879	.879
	RPI4	.830	.830
	RPI5	.840	.840

Table 11 shows the comparison of measurement and SEM model. The data were similar with minimum differences for both models. Based on the data, it can be concluded that the model is a good fit.

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Hypothesis Testing Results

Table 12. Hypothesis testing

	Dependent Variable	Independent Variable	Estimate	p	Results	Hypothesis Decision
H1	Repurchase Intention	Web Quality	.331	.010	Supported	Accepted
H2	Repurchase Intention	E WoM	.016	.842	Not Supported	Rejected
H3	Repurchase Intention	Service Quality	.309	.002	Supported	Accepted
H4	Repurchase Intention	Credibility	.180	.029	Supported	Accepted
H5	Repurchase Intention	CRM	.109	.163	Not Supported	Rejected

- **H1:** Web Quality positively and significantly impacts ORI

This hypothesis is well supported and shows that perceived web quality has a direct positive significant impact on ORI. Saying that, there will be an increase of 33.1% in repurchase intention if the web quality increases by 1% ($\beta = .331$, $p = 0.010$). These findings are similar to the study by Razak et al., (2016) that web site quality has a positive significant impact on repurchase expectation. As such, the customer's perspective on organization quality and satisfaction with the organization has a beneficial outcome by and large on the enthusiasm to buy later (Moeeini and Fard, 2014). A good web quality with adequate information on product can ease the customer's decision in making assessment and comparison of the said product. These will indeed increase the desire of customers to carry out future purchase again. As such positive perceived web quality is a great value to online shopping retailers. Hence, H1 is supported.

- **H2:** Service Quality positively and significantly impacts ORI

It is found that perceived service quality has a direct significant impact on repurchase intention in online shopping Malaysia. The findings show that an increase in perceived service quality by 1% will lead to an increase in repurchase intention by 30.9% ($\beta = .309$, $p=0.02$). The past research has exhibited that speedy thing transport and effortlessness of thing return by and large augmentation a customer's sure experiences, including increasingly essential bliss and delight similarly as fulfillment of their essential objective of purchasing a thing on the internet (Ha and Stoel, 2009). In other words, if customers are given an excellent service quality such as queries responded promptly and the most importantly the quality and quantity of the product is in order it will lead to intention to purchase. The conclusion of this research was in line with the finding of Agarwal and Bhati (2016) stating that service quality is dynamically being seen as a fundamental component of web shopping organizations' quality, impacting a customer's impression of shopping regard, similarly as satisfaction and repurchase objective (Tirtayani & Sukaatmadja, 2018). Thus, H2 is supported.

- **H3:** Credibility positively and significantly impacts ORI

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It is seen that perceived risk (β =.180, p=0.029). has direct significant impact on ORI. It shows that 1% increase in perceived risk can influence customers repurchase intention in online shopping Malaysia by 18%. As indicated by Tham et al. (2019), of the six sorts of apparent hazard (money related, by and large execution, time, delivering, privateness, mental and social possibility), four dangers were regularly utilized inside the see of dangers in an electronic interceded condition over the span of investigations of internet buying in the term 2003-2012: monetary peril, item chance, comfort danger and non-transport risk (Benazić & Tanković, 2015). The more possibility buyer sees, the less plausible it's far that they may make a buy (Zhang et al., 2012); because of the reality the way that "buyers are more noteworthy much of the time urged to avoid botches than to boost utility in shopping" (Mitchell, 1999). Therefore, H3 is supported.

- **H4:** CRM positively and significantly impacts ORI

CRM has direct positive significant impact on repurchase intention in ORI but such effect is not significant as outcome of current analysis (β =.109, p = .163) . This finding is in contrast with Roushdy and Ali (2017), stating that CRM (customer engagement) significantly and positively influences repurchase intention. According to Kumar (2012), the effect of client commitment yields an incentive on the repurchase expectation can be estimated by the quantity of clients pulled in, number of clients held, and what amount did those clients' going through with an organization has been expanded over the time. However, current study positions opposite finding when it comes to impact of CRM on ORI. Hence, H4 is not supported.

- **H5:** E-WoM positively and significantly impacts ORI

This hypothesis is not supported as current study found that e-WOM does not have a major impact and such impact is insignificant on ORI (β =.016, p=0.842). In other word, there is no impact of e-WOM in the context to repurchase intention. This includes product reviews on internet and social media, recommendations, and overall ranking of a product. As stated by Henning et al., (2004), eWOM is characterized as any announcements made by future, present or previous clients about an item or endeavor, either positive or negative, and is available by anybody on the web (Arif, 2019). The finding of this hypothesis differs from the exploratory study that showed eWoM builds repurchase intention (Liang, Choi & Joppe, 2015). Hence, H5 is not supported.

CONCLUSION

Several factors impacting ORI and determining ORI has been identified by extant literature. However, ORI being an evolving phenomenon with alternations in consumer behaviors in the context of contemporary challenges and recovery, rethinking and reinvestigation of such factors were required. This need was fulfilled with current study by first reviewing current ORI literature and developing appropriate construct following investigation of impact of such constructs on ORI. The study formulated five main constructs based on grouping of several ORI factors existed in current literature. These fresh determinants are web quality, service quality, credibility, e-WOM and CRM. These construct covers all those aspects which possibly could influence ORI. Findings show that web quality, service quality and credibility are key

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determinants of ORI in stated research context while e-WOM and CRM displayed insignificant impact. Notably, web quality demonstrated strongest impact followed by service quality and then credibility.

Research has several managerial implications accordingly. In order to enhance ORI, managers are recommended to increase web quality of their e-business portals. This can also be extended to mobile apps of businesses. Effective web quality in terms of navigations, interface and convenience will result in more repurchases from online consumers. Concurrently, service quality matters as well in online context whereby it mainly comprises of aspects like on time delivery, products as per promised etc. Importance of service quality is well known in traditional in-store businesses context. Current study extends the same in E-Commerce context. It is also advisable to ensure privacy and safety specially related to financial transactions while shopping online. Such risks are often deterred repurchase intentions and enhancing credibility would result in better ORI.

Like any other study, the current study also has some limitations which in turn opens avenues for future research. This study has identified fresh determinants of ORI based on extensive literature review. However, identification of determinants through in-depth interviews or exploratory study would further provide insights into ORI phenomena. The study has limitations in terms of selection of sampling through non-probability sampling posing issues with generatability. The data collection is carried out in Malaysia posing issues with transferability at the same time other transferability issues exists among different demographic sections. Future research can conduct interview based qualitative data analysis and explore factors affecting ORI. The model can further be tested for cross-sectional and multi-national data.

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KEY TERMS AND DEFINITIONS

Credibility: Credibility of the online portals is defined as the confidence level that can exist between online consumers and online retailer for being trusted and believed before entering into a financial transaction. It is a subjective component for believability of a source or sometimes a message.

Customer Relationship Management: It is defined a business process through which online businesses tries to interact with their customers by utilizing analytical data to study customers' behaviour in order to be able to retain its clients by enhancing their loyalty.

E-Word of Mouth: Electronic word of mouth is the process of passing information from customer to customer by utilizing online means such as posting of reviews, comments, likes, online recommendations, etc.

Online Repurchase Intention: Consumers' willingness to buy a product (s) or brand(s) from a same online store repeatedly can be described as consumers online repurchase intention. It is also termed as repeat purchase, continuance intention etc. in marketing literature.

Service Quality: It is the comparison of perceived expectations of a service provided by online retailer comparatively to the perceive performance of the service by such online retailer.

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Chapter 6
The Role of Ecological Cognition for Supporting Webometrics:
Towards "Serendipity Engineering for Seductive Hypermedia" and "User Analysis Using Socialnomics"

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ABSTRACT

This chapter investigates the long-established ecological cognition framework and updates it to better account for the advances in digital transformation. To do this, two concepts are explored. The first, 'serendipity engineering for seductive hypermedia', looks at how to design information systems to account for the pleasant occurrences that happen in offline environments studied by those in sales and marketing where beneficial outcomes often occur by chance encounters. The second, 'user analysis using socialnomics', looks at how a parametric user model based on the ecological framework can be used to understand users of information systems from the point of view of supporting a digital economy of users. A number of additional equations are developed using socialnomics that can be applied to digital transformation based on the parametric user model, including to calculate probability of seduction and probability of serendipity in an information system. The parametric model presented has great applicability for information and communications technology solution providers.

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INTRODUCTION

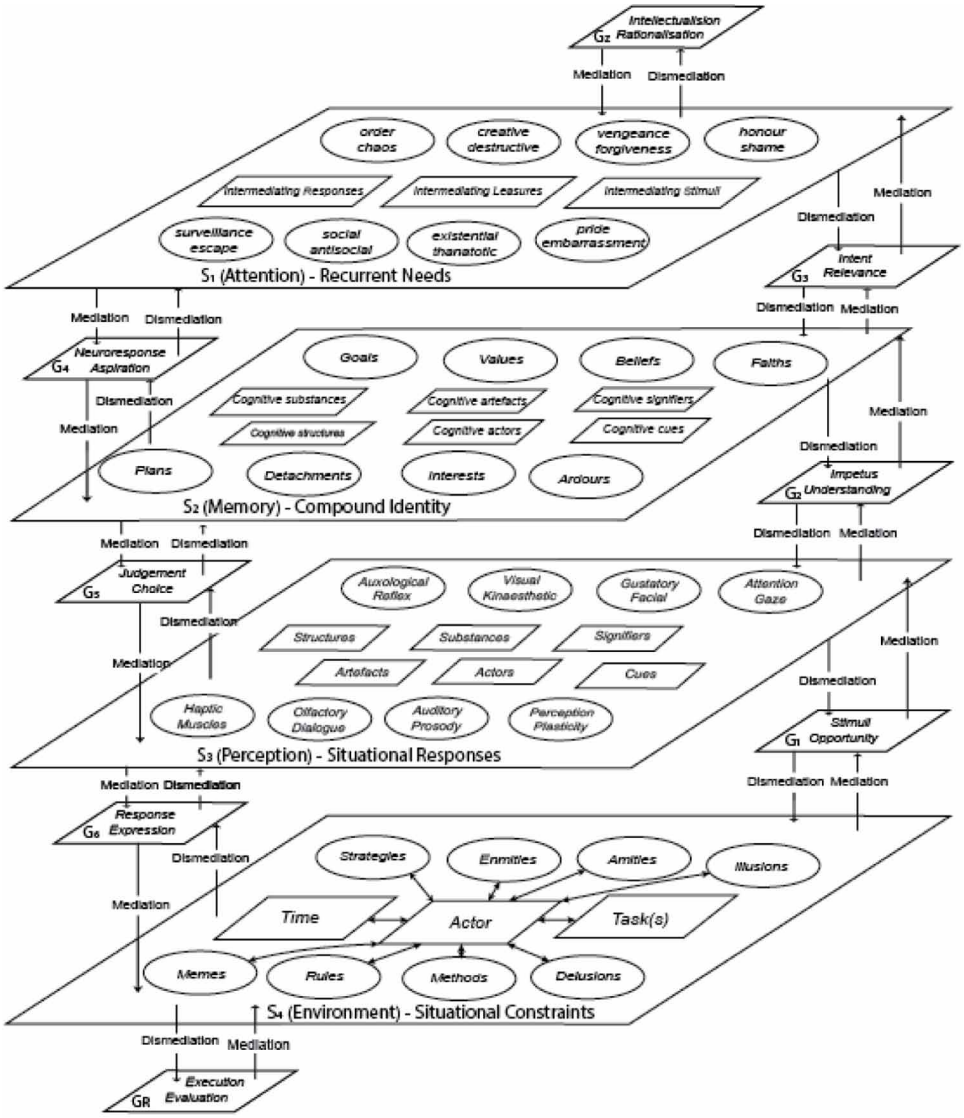
It has been argued that one of the greatest challenges in intelligent systems design is to harness "technologies to verify and apply longstanding theories from distributed AI, agent systems, and other areas of networked intelligent systems research" (Willmott, 2004). It has been argued that intelligent systems research is required to "prevent users being overwhelmed by the complexity of the systems with which they will be asked to interact" (Steventon & Wright, 2010). One approach to intelligent systems research is to designing intelligent systems that think and act like humans (de Lope, 2007) is ecological cognition (Bishop & Goode, 2021).

Ecological Cognition

An essential premise of ecological cognition is that the world which we observe is socially constructed from how we perceive it and we then construct an alternative reality, whether it be called our unconscious or sub-conscious, that is more consistent with the reality we would prefer to perceive (Bishop, 2007; Hutchins, 2000; Jensen, Thomas W., 2017; Jensen, Thomas Wiben & Greve, 2019; Johansson Falck, 2018). Through using these, how our reality is constructed can be described, including by drawing on the dedicated multimedia studies literature, such as that recommended elsewhere (Cunliffe & Elliott, 2005). The most recent ecological cognition framework is presented in Figure 1 is associated with a parametric user model in Equation 8 (Bishop & Goode, 2021; Bishop, Kommers, & Bechkoum, In Press), which provides an exemplary means to create intelligent systems even compared to earlier embodiments (Bishop, 2013).

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Figure 1. The 8-Base ecological cognition framework



Webometrics

Webometrics is a new field based on analysis of new forms of data; therefore, methods of data collection and processing have been prominent in many studies (Thelwall, Vaughan, & Björneborn, 2005). Webometrics is an information science field concerned with measuring aspects of the World Wide Web (WWW) for a variety of information science research goals (Thelwall, 2009).

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Socialnomics

In contrast with webometrics, socialnomics is designed for a range of social science goals. Equally it relates not only to the online world, but events which occur offline also (Maina, 2017). Socialnomics is the value created and shared via social media and its efficient influence on outcomes (Yao, 2016), so could be seen as a subset of webometrics.

Serendipity Engineering

It has been argued that Serendipity Engineering "builds upon randomness, interaction, chaos and complexity for innovative aspects and directions to be identified and taken advantage in favour of the user. In this way, serendipity and unintended outcomes can be manipulated to orchestrate pleasant surprises" (Lambropoulos, Fardoun, & Alghazzawi, 2016). Serendipity Engineering builds upon randomness, interaction, chaos and complexity (Lambropoulos et al., 2016).

BACKGROUND

Ecological cognition can be used for information modelling from a socialnomics angle because it specifies the ontological entities that can be used to categorise and classify elements of the world, which is a social environment in most cases. More were developed over time as it became clear how relevant the ECF was to the design of information systems with an online community element (Bishop, 2009).

Table 1. Types of social economic artefact in ecological cognition

ECF#	Cognition	Signifier	Range	Range Source	Description
4	Goal	Strategy	1 to 9	(Brawley, Carron, & Widmeyer, 1993; Senécal, Loughead, & Bloom, 2008)	A goal is an aim to carry out a given behaviour. Often it might be tied to Signifiers like Amities when
4	Plan	Method	-2 to +2	(Bamberg, 2003)	A plan is like a goal but has more immediacy or certainty, taking the form of a directed behaviour.
4	Value	Rule	1 to 4	(Baron-Cohen, Richler, Bisarya, Gurunathan, & Wheelwright, 2003; Mitchell, 1983)	A value is a strong conviction about something.
4	Belief	Meme	-3 to +3	(Fishbein, 1967b; Fishbein & Ajzen, 1980)	A belief is an inclination to a particular point of view.
5	Interest	Amity	1 to 10	(Argyle, 1992; Argyle, 1994)	An interest is an attachment to another actor, a substance, structure, etc.
6	Detachment	Enmity	0 to 6	(Hansen, 1982)	A detachment is a distancing from another actor, substance, structure, etc.

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Table 1 shows the cognitions that link the unconscious mind with the conscious mind and the signifiers that like the external world with the internal world we construct. The ECF# refers to the Base-4 one that jumped out of my mind months after completing my MSc in E-Learning, the Base-5 one I presented at a conference (Bishop, 2005), in a journal (Bishop, 2007c) and in a book (Bishop, 2007a), the Base-6 one that is in a book chapter (Bishop, 2019) and the Base-8 one that is introduced by this chapter.

A goal as a cognition is very similar to a strategy as a signifier, especially when it comes to learning objectives (Saul, Becker, Hofmann, & Pharow, 2011). A goal cognition refers to the degree to which someone aspires to do something, ranging from 1 to 9, with 1 representing the lowest priority and 9 representing the highest priority. The scale was chosen based on selecting it from the literature (Brawley et al., 1993; Senécal et al., 2008).

Methods as signifiers can be seen as the globalised equivalent to the plan cognition (Beetz & McDermott, 1992). A plan cognition refers to the degree to which someone intends to do something, ranging from -2 to +2, with the lowest representing something they do not want to do and the highest something they do want to do. The scale was chosen based on selecting it from the literature (Bamberg, 2003).

The cognition, value, and the signifier, rule, are highly linked, especially with regards to online communities (Pentina, Prybutok, & Zhang, 2008). A value cognition refers to the degree to which someone identifies with a particular way of being or philosophical position, ranging from 1 to 4. The lower the score then the lower a person values the sentiment being measured as being reflective of them. The scale was chosen based on selecting it from the literature(Baron-Cohen et al., 2003; Mitchell, 1983).

A belief cognition refers to the degree to which someone holds particular points of view, ranging from -3 if an actor does not believe something at all to 3 if an actor beliefs something completely. The scale was chosen based on selecting it from the literature (Fishbein, 1967a; Mowen & Minor, 2001). Memes have the same scale but refer to an external representation in the form of a belief or point of view that is often shared by members of a community.

An interest cognition is an internal representation that relates to how close someone is to someone else, ranging from 1 to 10. Such cognitions can be brought into mind when a person with whom they know enters a space in which they are present, where the interest would be closer to 10. For people they do not know, or who do not look like people they are familiar with, interest will be closer to 1. The scale was chosen based on selecting it from the literature (Argyle, 1992; Argyle, 1994). The signifier that takes the form of a corresponding external representation to interest is amity. An amity is a person in the environment that an actor has an affinity or close relationship with.

A detachment is a cognition (i.e., internal representation), ranging from 0 to 6, reflects how distant someone is from someone else. If an actor does not have any negative impact on their life then they may rate that person as 0, or if an actor has a serious negative impact on someone's life then they may rate that person as 6. As with all cognitions, the higher the value the more cognitive load on the person. In multi-actor environments an actor could be faced with managing multiple cognitions towards different people. The signifier (external representation) equivalent of detachment is an enmity, reflecting the existence of such people an actor has poor relations with.

An essential premise of ecological cognition is that the world which we observe is socially constructed from how we perceive it, and we then construct an alternative reality, whether it be called our unconscious or sub-conscious, that is more consistent with the reality we would prefer to perceive. Through using these, how our reality is constructed can be described, including by drawing on the dedicated multimedia studies literature, such as that recommended elsewhere (Cunliffe & Elliott, 2005).

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If one uses the work of Mantovani, especially his book 'Exploring Borders' (Mantovani, 2000) one can see that the cognitions and signifiers referred to in Table 1 are what he called Objects. Cognitions in this context can be seen to be internal representations and signifiers can be seen to be external representations. Signifiers, associated with the work of Don Norman (Norman, 2013), often trigger internal cognitions which if part of a seductive hypermedia strategy based on captology can result in a target behaviour, which may include feelings of serendipity (Fogg, 2002; Mbakwe & Cunliffe, 2002; Mbakwe & Cunliffe, 2007; Mbakwe & Cunliffe, September 25 2003).

This chapter introduces two new cognitions with their associated signifiers to those mentioned earlier. The first cognition is faith, which is associated with the signifier illusion. In terms of the scale it is either Null or 1. The second new cognition introduced by this chapter is ardour, which is associated with the signifier, delusion. In terms of the scale it is either -1 or Null. In both case they reflect the fact that for some cognitions and signifiers an actor will have an absolute opinion either for or against something or no opinion at all and nothing could change that.

Table 2. Additional cognitions and ranges from the ecological cognition framework

ECF#	Cognition	Signifier	Range	Range Source	Description
8	Faith	Illusion	Null to 1	Introduced by this chapter (Icke, 2017).	A faith either exists or does not exist and if it exists it has 100% certainty and is unchangeable. It is usually something someone wants to be true, but it is not guaranteed it is.
8	Ardour	Delusion	-1 to Null	Introduced by this chapter (Icke, 2017).	An ardour either exists or does not exist and if it exists it has 100% certainty and is unchangeable. It will make no difference to the person whether or not their position is based on fact or fiction.

Some have tried to distinguish between the unconscious preferred truth as being 'subjective' and the conscious accepted but unwanted truth as 'objective' (Searle, 1996). In terms of the Base-8 ecological cognition framework, the former could be 'ardours' and the latter 'faiths' (Icke, 2017). It has been argued that there are institutional truths in that the existence of external artefacts does not depend on any beliefs we may hold about those artefacts (Searle, 1996). In other words, in reality, a spade is a spade because it has been designed for shovelling, not because one believes its colour matches the wheelbarrow one might have. Importantly, however, just because this is a fact it does not mean a person will accept it as a fact if they value, beliefs, faiths and ardours contradict that reality. It is important at this point to draw attention to the concept of affordances, whether those described by Don Norman (Norman, 1999) or those described by JJ Gibson (Gibson, 1986). In terms of the latter, it was argued through light directly affecting the brain it is possible to "pick up" how to use a previous unexperienced artefact (Gibson, 1986).

The cognitions of faith and ardour and their signifier equivalents of Illusion and delusion respectively, are unique to this chapter in terms of the ECF and based on labels where religious people identify with the positive faith cognition and people with other negative philosophical positions, including pseudo-religious Atheists, can identify with the ardour cognition (Icke, 2017). The importance of adding these cognitions is to account for situations where it is not possible for an actor to have an opinion that is anything other than black and white – they either agree with the position or have no interest in having an opinion on it. In terms of the faith cognition some people will believe in God 100% (faith=1, phantasy=5)

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even if they have no proof and in the case of the ardour cognition some scientists who are atheists will believe science at the time of writing is able to disprove the existence of God with 100% devotion to that perspective (ardour=-1, phantasy=-5), even though no instruments or models exist to support it.

The main difference between the two new cognitions (Icke, 2017) and the six existing ones is that the existing ones relate to matters that are not fixed in the actor's mind and might change from moment to moment, whereas the new ones are fixed and are unlikely to change with normal methods of persuasion. So, for instance, when an actor is completing a questionnaire, they may give inconsistent answers when relying on the six fluid cognitions but will give the same answer each time for the two fixed cognitions. When one of the six fluid cognitions are consistently at their maximum or minimum it might be that they are actually a faith or ardour. Table 3 presents the binary-opposition forces developed across the Base-4 through to the Base-8 ecological cognition frameworks, which can be used by clinical psychologists to find out what motivates their clients.

Table 3. Binary-opposition forces (Attention-driven recurrent needs)

#	ECF#	Force	Emoticon	Description
1	4	Order	|-)	An actor will post something pleasing to others in order to support their own worldview.
2	6	Chaos	:-D	An actor will seek to entertain others and bring some entertainment to the community.
3	4	Vengeance	:@	An actor will seek to get justice if they feel they have been wronged in some way, such as being the victim of "misinformation".
4	6	Forgiveness	:-o	An actor will have a presence of forgiveness if they are willing to let bygones be bygones, even if the other parties are not of the same mindset.
5	4	Social	:-)	An actor will be driven to socialise with others whether for the benefit of that individual, themselves or both.
6	6	Anti-social	8o)	An actor will be driven to express their dissatisfaction in a manner others might perceive as anti-social.
7	4	Existential	;-)	An actor will have certain bodily requirements that will exist regardless of whether or not they want to act on them. Some will act on them even if it is to the disadvantage of others.
8	6	Thanatotic	:-(	An actor will have feelings of despair when they are not achieving their goals.
9	4	Creative	8-)	An actor will want to express their ideas and other information in a permanent form.
10	6	Destructive	^o)	An actor will want to erase from record information they find unsuitable
11	6	Surveillance	:-#	An actor will seek out information on things that interest them, specially to keep up-to-date.
12	6	Escape	:-|	An actor will seek out information on others to escape from their own concerns.
13	8	Honour	:-""	An actor will feel pride in their creations even if they did not work out as planned when responded to by others.
14	8	Shame	:-N	An actor will seek to bring life to a community they otherwise think is left wanting.
15	8	Pride	:-8	An highly thought of actor who will try to do all they can to help others.
16	8	Embarrassment	:-0	An actor will seek to put right the things that have gone wrong for them due to misunderstandings of others even if they fear them.

The forces of 'Vengeance' and 'Forgiveness' were in the original 4-Base mode (Bishop, July 04 2005) l in the case of the former (Hardaker, 2010), before later becoming a binary opposition force with the addition of the latter (Cassidy, Brown, & Jackson, 2013) in the 6-Base model (Bishop, 2019; Bishop,

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April 08 2006). The forces of 'Social' and 'Anti-social' were in the original 4-Base model (Bishop, July 04, 2005) in the case of the former (Rheingold, 1993; Rheingold, 2000), before later becoming a binary opposition force with the addition of the latter (Lubit, 2003) in the 6-Base Model (Bishop, 2019; Bishop, April 08 2006).

The forces of 'Existential' and 'Thanatotic' were in the original 4-Base model (Bishop, July 04 2005) in the case of the former that drives 'chatroom bobs' (Jansen & James, 1995; Jansen, 2002), before later becoming a binary opposition force with the addition of the latter (Sosnowska, 2013) in the 6-Base Model (Bishop, 2019; Bishop, April 08 2006). The forces of 'Creative' and 'Destructive' were in the original 4-Base model (Bishop, July 04 2005) in the case of the former (Muirhead, 2007) before later becoming a binary opposition force with the addition of the latter (Shachaf & Hara, 2010) in the 6-Base Model (Bishop, 2019; Bishop, April 08 2006).

The binary opposition forces of 'Surveillance' and 'Escape' were left out of the original ecological cognition framework (Bishop, July 04 2005), because they were only considered to be drivers for the Net Generation (Leung, 2003). They were, however, added to the 6-Base Model (Bishop, 2019; Bishop, April 08 2006).

The binary opposition forces of 'Honour' (Wanamaker, 1987) and 'Shame' (Wiher, 2002) as well as 'Pride' (Johnson, 2012) and 'Embarrassment' (Gilbert, 1998) have been added to the 8-Base ecological cognition framework by virtue of this chapter.

Table 4. The stages and values of the ecological cognition frameworks

ECF#	Stage	ECF 5 & 8 Stage	ECF 6 & 8 Value	Description
5	1	Stimuli	Opportunity	A stimulus draws an actor's attention to an opportunity in the environment that might enable them to achieve their goals.
4	2	Impetus	Understanding	An impetus is an understanding of a perceived stimuli within the competencies of the actor.
4	3	Intent	Relevance	An intent is a driver to act on a stimulus once an actor is convinced of its relevance to their goals.
8	4	Intellectualisation	Rationalisation	An intellectualisation is a driver for an actor to make use of their personality to advance their goals.
4	5	Neuro-Response	Aspiration	A neuro-response is an instruction on the brain on how an actor can achieve an aspiration towards a particular goal. More often than not these are based on pre-existing cognitions than new thinking.
4	6	Judgement	Choice	A judgement is an actor's choice to either act on a neuro-response or to dispose of it in some way. Sometimes a situation moves so fast their choice is based on prior experience not present thinking.
5	7	Response	Expression	A response is an internal or external expression of an actor's judgement, which can include suppression or repression.
7	8	Execution	Evaluation	Through higher-order reflective thinking an actor can evaluate themselves or others by using their mind to mediate between the stimuli that went into them and the response that came out of them. In many cases neither are directly planned by the actor when executed following an expression.

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As has been discussed, the ecological cognition framework has gone through a number of iterations (Bishop, 2011; Bishop, 2019; Bishop, April 08, 2006; Bishop, July 04 2005; Bishop, September 08 2009). Table 4 shows the framework updated for the current chapter where the framework is 8-Base, building on the previous 6-Base model (Bishop, 2019) . The main difference is that there are two additional stages and values based on work on the original 6 stages (Bishop, 2011; Bishop, 2014; Bishop, 2017), which has shown that actors will deindividuate to reflect on a situation in the case of the new stage 4 and reflect to develop higher order thinking in terms of the new stage 8 (Norman, 1991; Vygotsky, 1930). It has been asserted that an actor will develop a plan cognition after they acted on a goal cognition and not before they have done it (Suchman, 1987; Suchman, 2007). It has been asserted that the normal innate and learned reactions between stimuli and response (Pavlov, 1927) can be changed through the use of tools and signs (Vygotsky, 1930), which if external are signifiers (Norman, 2004). It has been asserted that when fulfilling their goals that actors will be limited by their competencies (Mantovani, 1996) and this will affect their target behaviours (Fogg, 2009) .

The discipline of ecological cognition (EC) can be applied through serendipity engineering for seductive hypermedia and user analysis using socialnomics (SESH-UAUS). This can be done by making use of the parametric user model, including to produce k-scores for use with statistical packages like SPSS (Field, 2005) in order to advance computational science and computational intelligence. The parametric user model in Equation 8 below places phantasy construction as an esteem need and fantasy construction as a deficit need. The equation assumes that psychological nutritional intake (n) is half that (0.5) of what is needed for an optimal cognitive state with consonance reflected as a joinder (j) of 1. Therefore, for an optimal state, where Ob is 48 and knol is 1, nutritional intake needs to be multiplied by two to balance the two parts of the equation reflecting interval. Equation 8 therefore shows all aspects of the parametric user model as one equation for the calculation of knol (k), which is the speed of memory access. This it could be argued, along with the ecological cognition frameworks, is one of the main conceptual frameworks contributed by this paper. This can be seen as a progression of the earlier equations, where x1 has been replaced with ca_{eS}, y1 has been replaced with cb_{eS}, $\check{z}$ has been replaced with cc_{eS} and c with c_{1eS}.

PARAMETRIC USER MODELLING

Parametric user modelling when it comes to the World Wide Web (WWW) can be seen as an applied form of webometrics. One of the objectives of this research study is to develop a parametric user model that can be used to analyse and influence behaviour in information systems, particularly online communities. Figure 2 was an attempt to develop a parametric user model conceptually as a starting basis for devising an equation (Bishop, 2002; Bishop & Goode, 2014). The various elements of this prototype parametric user model are explained in Table 5.

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Figure 2. A prototype parametric user model based on the ecological cognition framework

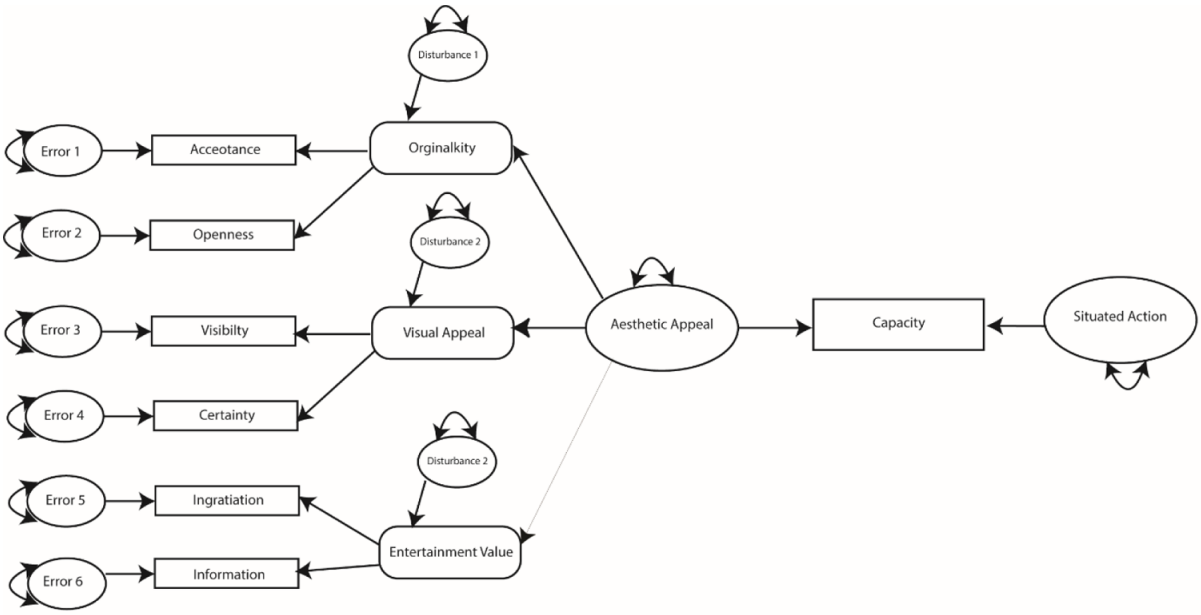


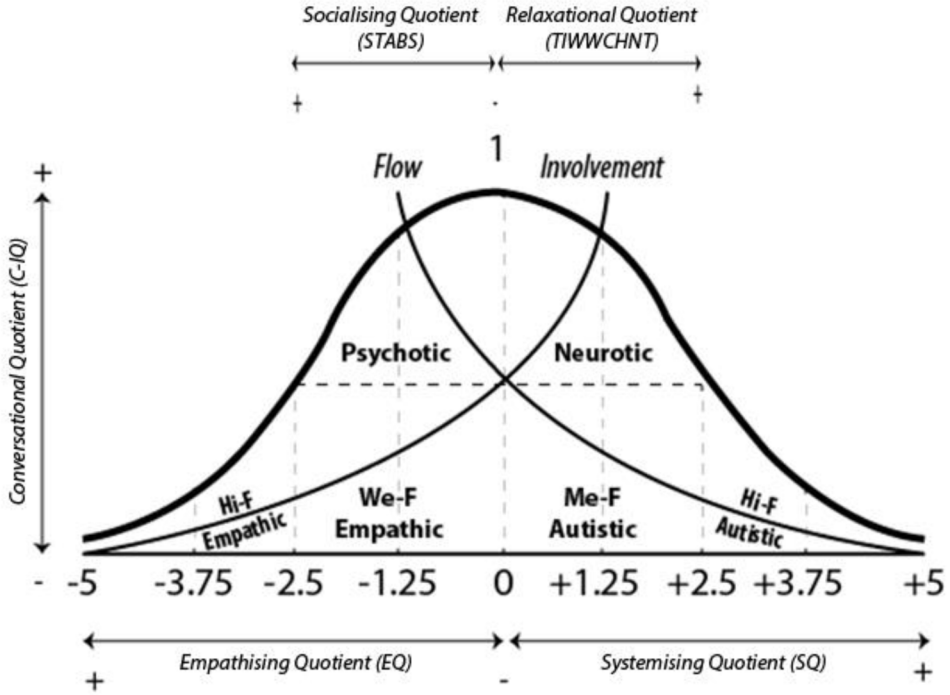
Table 5. A table explaining the prototype parametric user model

Trigger	Parametric value	Description
Disruption Mechanism	A Pression (P) is made up of phantasies (p_c) consisting of antecedents (a, x) and succedents (s, y) which have been converted to a range of -5 to +5	Antecedents (a), valued according to the stimuli being external (x) to the actor trigger an internal (y) mental state called a succedent (s). Both x (or a) and y (or s) could be considered cognitions based on distributed cognition theory.
Error (Part of Disruption Mechanism)	Joinder (j) is the extent to which external (a, x) or internal (s, x) cognitions are consonant.	A joinder, valued at 1 when an actor's cognitions are most consonant, affects the plasticity of the brain due to whether cognitions are connected and therefore facilitate an actor in achieving their goals. It is what makes an actor feel alive or demotivated. A joinder measures the link between an external representation and an internal cognition.
Disturbance (Part of Disruption Mechanism)	Intercedent (i) reflects the extent to which interventions have on changing the degree of consonance or dissonance a person experiences.	An intervention, valued from 0 to 1, interacts with the joinder to either improve consonance or increase dissonance.
Seduction Mechanism	The procedure of transferring from one state of mind to another based on influences from other actors or other representations (i.e. x, a, i).	The seduction mechanism is the means by which an actor can be convinced to change from one state of being into another, whether physical, mental, or a combination of the both.
Conversion (Part of Seduction Mechanism)	Conversion (c) is the instigator of an actor moving from being aware something has happened to deciding to change their situation.	A conversion is a value that transforms an actor's mental state from having the potential to perform an action to either performing it or abandoning performing it.
Capacity (Part of Seduction Mechanism)	Capacity or Humanpower (H) consists of fantasies (f_d) which come as a result of internal substances (z) acting in association with external representations (x, a) as a succedent (s).	Capacity (X) is valued at 1 when an actor has their optimal level of bodily nutrition (2n), which might include medication, affects the effectiveness by which a person is able to carry out their goals. It measures the link between the same external representation (x, a) as joinder (j), but with an internal physiological element (z) in the form of a precedent (p) substances producing fantasies (f) not a cognitive one (y, s) producing phantasies (p).
Situated Action (Transformation)	A situation (S) consists of an Event (E) that has Consequences (C). All the above form part of such an Event.	A situated action is a deed performed by a user which they might not be aware they have carried out until after they have reflected on the situation in which it occurred. On this basis the actor's plan to do something comes after they do it and not before.

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Figure 3 shows how the ecological cognition framework could go from a simple theory about how online communities work (Bishop, 2005; Bishop, 2007a; Bishop, 2007c) to being able to determine personality types that have application in pre-existing clinical psychological frameworks. Future research would have to use methods like multiple linear regression to compute intervention (i) and joinder (j). On the basis of Figure 3, it is possible that j is directly proportional to flow (Z) and i is directly proportional to involvement. This is because joinder is the degree to which cognitions are consonant and the more consonant a person's cognitions the higher their state of flow (Z) and intervention is what enables or disables a person in achieving their goals and so if involvement (I) is high then intervention (i) is likely to resemble more of a resisting force and if I is low then i is more likely to resemble an enabling force.

Figure 3. The Personality Continuum



As dopamine is linked to flow (Zd) and serotonin is linked to Involvement (Is), it is also likely that glutamate is linked to flow (Zg) and glutamine is linked to involvement (Ig) and all these impact on melatonin to produce Melatoninergic equilibrium (Me), which k is also likely to co-vary with. That is, as knol goes up then melatonin goes down and as knol goes down melatonin goes up. One's Me depends firstly on the time of day – one should ideally be producing less knols at night when one is sleeping – and one's knol should be higher during the day when one is being productive.

Equation 1 presents a theory of general memory in the form of a model for calculating knol, which is the proposed speed for memory access based on using the ecological cognition framework. It can be compared with Fogg's behaviour model in that k (knol) measures brain productivity, which can be used

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to measure whether a target behaviour has been achieved; P (Pression) is cognitive, so can be seen to reflect motivation in Fogg's behaviour model; H (Humanpower) reflects a person's physical competence to achieve their cognitive drives, so can be seen to reflect ability in Fogg's model.

$$k = \frac{P}{H}$$

Equation 1. A theory of general memory

It is called a 'theory of general memory' (TGM) because knol can calculate the speed at which the brain is accessing memories, such as 'phantasies' and the cognitions which can be derived from them, but that its elements, Pression (P) and Humanpower (H), have complex calculations that lead to them that would only need to be explained when developing systems to compute them. The aim of every organism to exist is to achieve a knol of 1, which is done when P and H are equal. If humans ever achieved this at a sustainable level, they would have reached the homomagnus equilibrium (Bishop, May 19 2013), leading to the Nash equilibrium being disproven. One of the main elements of Pression (P) are memories stored as 'phantasies' (p) as can be seen from Equation 2. The values required in order to compute Equation 2 are in Annex I.

$$p_e = \left(\frac{\left(\left(x + x_1 \right) * \left(y + y_1 \right) - \breve{z} \right) / \left(i + j \right) \right)_e}{c} \right)$$

Equation 2. Calculating a phantasy (p_i) using external antecedents (x) and internal succedent (y) and converters x_1, x_2, ($\breve{z}$, I, j, c)

If one thinks of the equation for general relativity ($e=mc^2$), e refers to energy measured in joules, m refers to mass measured in kilograms and c refers to the speed of light. The variable knol (k) is the equivalent of speed of light in the brain, namely the speed of human memory. Pression is like mass inversed, as it is the pressure on the brain to perform specific goals and other cognitions. Humanpower is then obviously like energy, which is the capacity of the person concerned to achieve Pression, namely the nutrition available to the brain and body to power a human actor.

$$P = \left(\frac{\sum_{e=0}^{M} \left(\frac{\left(\left(x + x_1 \right) * \left(y + y_1 \right) - \breve{z} \right) / \left(i + j \right) \right)_e}{c} \right)}{5} \right) + F$$

Equation 3. An equation for calculating 'Pression' taking into account 'j' and 'j'

Equation 3 shows how to calculate Pression (P), which is the accumulation of all of an actor's cognitions into their working memory. It represents mentally what they want to achieve at a given point in time. Actors with conditions like mania, where they have racing thoughts, are likely to have a higher Pression than say actors who are alcoholics or smoke cannabis recreationally, who are likely to have a much lower Pression.

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$$k = \frac{\left(\frac{\sum_{e=0}^{M} \left(\frac{\left(\left(x + x_1 \right) * \left(y + y_1 \right) - \breve{z} \right) / \left(i + j \right) \right)_e}{c} \right)}{5} + F}{\left(F + B \right)}$$

Equation 4. An interim parametric user model for calculating 'knol' taking into account 'j' and 'I' but not 'n'

Equation 5 is the first complete model for calculating knol prior to this chapter extending it with the parametric user model (Equation 8, page 12). It was based on the Base-6 ecological cognition framework that introduced the detachment cognition. The new cognitions of faith and ardour and their corresponding fantasies of hope and fear have also been added. Annex I presents Table 7 to Table 14 presents the figures for using Equation 5 to convert cognitions into phantasies (p_i) or fantasies (f_i), which are what (F + B) is partly composed of in Equation 8.

Equation 4 shows how to transform Pression into knol for two of the 8 representations and emphasises the fact the Humanpower is most easily calculated by adding Force (F) to Baseline (B). Baseline (B) is the number of hours an actor is able to work without developing psychosis or neurosis in the form of a suboptimal amount of Humanpower (H). Force (F) is the maximum number of hours an actor should be able to work in a week if they were at their peak performance, which is based on the hours in the Working Time Directive, namely 48. Therefore i (i.e. intervention) will have to account for some of the variance of F + B. When you add F and B together you get Humanpower (H). Equally, because the top half of the equation represents Pression – the amount of pressure put on the brain by receiving a stimuli and problem solving to produce a response – then j (i.e., joinder) will have to account for some of the variance of that value. A person who never lies to themself would have a j of 1, because their cognitions would likely be completely consonant.

Mediating artefacts are reflected throughout the parametric user model in the form of external representations (antecedents like a or x), internal representations (succedents like s, y or z) and those that mediate between them, like intercedents (i) and joinders (j). Equation 5 shows how to calculate a fantasy, which is the physical equivalent of a phantasy (Equation 2). The values for computing fantasy are in Annex I.

$$f_d = \left(\frac{\left(\left(x + x_1 \right) * \left(z + z_1 \right) - \breve{z} \right) / 2n)_d}{2c} \right)$$

Equation 5. An equation for calculating a fantasy (f_i)

$$H = \left(\frac{\sum_{d=0}^{D} \left(\frac{\left(\left(x + x_1 \right) * \left(z + z_1 \right) - \breve{z} \right) / 2n)_d}{2c} \right)}{2.5} \right) + Ob$$

Equation 6. An equation for calculating 'Humanpower' taking into account 'i' and 'n'

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As can be seen from Equation 6, Humanpower can be calculated in a similar way to Pression, but on a scale of -2.5 to +2.5 instead of a scale of -5 to +5. In place of Force (F) is Object (Ob), which carries much the same meaning as it does in Activity Theory, but not in the way it is used by Mantovani, which essentially refers to internal and external representations. Object (Ob) is the aim of a particular course of action an actor wishes to take and the reason for their behaviour in transforming their environment to achieve it and is measured in hours as Force (F) is. It's value is thus not the same as Baseline (B), which is what a person can actually achieve, but what they feel capable of achieving. The calculations inside the brackets of Equation 6 therefore calculate what is limiting an actor from achieving their potential and is thus what contributes to psychosis and neurosis. Table 6 details the variables that make up Equation 6.

Table 6. Other variables and their values which form part of the parametric user model

Variable	Symbol	Default Value(s)	Description
Baseline	B	<=48	Baseline refers to the number of hours a person is actually capable of working in a week.
Force	F	48	Forces refers to the number of hours a person at their peak will work if their operated at the homomagnus equilibrium.
Object	Ob	42	Object refers to the number of hours a person is normally able to work at their peak, which is below the homomagnus equilibrium.
Pression	P	-5, 5	Pression refers to the amount of pressure placed on the brain by phantasies and fantasies entering short-term and working memory.
Phantasy	p	-5 to +5	Phantasy refers to two joined representations that are linked to emotion.
Fantasy	f	-2.5 to 2.5	Fantasy refers to two joined representations that are linked to lifestyle.

We can assume that with all other things being equal that when knol is equal to 0.81 that Ob is 42 and when Ob is equal to 48 then knol is equal to 1. This means that with most people they feel capable of 6 hours less effort each week than they may be expected to under working time rules. An amalgamation of Equation 3 and Equation 6 is presented in Equation 8.

$$k = \frac{\left(\frac{\sum_{e=0}^{M} \left(\frac{\left(\left(x + x_1 \right) * \left(y + y_1 \right) - \breve{z} \right) / \left(i + j \right))_e}{c} \right)}{5} \right) + F}{\left(\frac{\sum_{d=0}^{D} \left(\frac{\left(\left(x + x_1 \right) * \left(z + z_1 \right) - \breve{z} \right) / 2n)_d}{2c} \right)}{2.5} \right) + Ob}$$

Equation 7. An interim parametric user model for calculating 'knol' taking into account 'j', 'I' and 'n'

Equation 8 provides an easy way to turn questionnaire-based scales, or observational device-based scales into a parametric user model for analysing and influencing human behaviour (Bishop & Goode,

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2021). The construction of information systems that impact on intervention (i), joinder (j) and nutrition (n) so as to influence the neurotransmitters resulting behavioural consequences of doing so could be an important part of situation ecological cognition in a digital economy. This could happen in online communities, where users' behaviour can be analysed and influenced using log data or other ways of attributing the values of the parametric user model. Equally, it could happen in organic communities, where actors sharing the same physical space could have their different levels of wakefulness accounted for by using physical sensors, including those based on the Internet of Things, to analyse and influence their behaviour. In order for this to be done, it is necessary to understand how the parametric user model might operate in large-scale virtual environments.

$$k_a = \begin{Bmatrix} C_{\min} \\ E_S \\ C_{\max} \end{Bmatrix} \frac{\left(\frac{\sum_{e=0}^{M} \left(\frac{\left(\left(x_{GS2} + c\breve{a}_{eS} \right) * \left(y_{GS2} + c\breve{b}_{eS} \right) - c\breve{c}_{eS} \right) / \left(i_S + j_S \right))_e}{c_{eS}} \right)}{5} \right) + F}{\left(\frac{\sum_{d=0}^{D} \left(\frac{\left(\left(x_{GS2} + c\breve{a}_{dS} \right) + \left(z_{GS4} + c\breve{b}_{dS} \right) - c\breve{c}_{dS} \right) * 2n_S)_d}{2c_{dS}} \right)}{2.5} \right) + Ob}$$

Equation 8. A parametric user model for calculating 'knol' for a given actor (k_a) using the ecological cognition framework (a theory of ordinary memory)

Using the Parametric User Model to Understand Serendipity and Seduction Among Users of Large-scale Virtual Environments

A LSVE based on the parametric user model be used to determine whether the group of users are likely to form part of a successful online community where opportunities for genuine serendipity could occur due to them being around fewer disagreeable actors. This could be done by measuring the standard deviation (SD) between the k-scores for each group (M_C) so that the lower the SD, the greater the chance that all the actors within that community (N_C) will have positive relationships. This is the principle of empathism (Bishop, May 19, 2013). People with empathism have a common way of thinking towards other actors like them and often in opposition to actors unlike them (Bishop, May 19, 2013; Bolognini, 1997) and so using Equation 8 with Equation 9 could allow for the selection of actors so that they form online communities of like-minded people, regardless of whether those communities are toxic (Leavitt, 2017).

Equation 9 shows how one might compute the mean knol for a specific online community of actors (M_{Ce}) within a community (N_C) (Bishop & Goode, 2021). In this context the N_C could refer to an online community being analysed using a management information system (MIS) with the purpose of seeing whether there is a difference in k-scores between the six different communities. The k-score would be calculated by applying the TIWWCHNT-20 Scale (Bishop, 2014) to a sample of actors and then assigning as y-values all the statements in the factor they score highest in, which would determine the community they belong to (N_C). The x value would be asking their position on the actor taking on the role of PUA in a given situation (S) in terms of their interest in them or detachment from them.

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$$M_{Ce} = \sum_{S=1}^{N_C} \frac{k_S}{N_C}$$

Equation 9. Mean knol for an optimised (e) community (M_C) based on k-scores (k_s) for that community (N_C) in a given situation (S)

$$\hat{S}k = \frac{M_{Ck}}{0.98}$$

Equation 10. Probability of Serendipity (Ŝk) based on Mean knol for group ($k=M_{Ck}$) and serendipity threshold (k=0.98)

Equation 10 shows an alternative to standard deviation, namely the probability of serendipity (Ŝk) occurring based on dividing the Mean k-score for a given group by the serendipity threshold of 0.98 (Bishop & Goode, 2021). The further the Mean from the serendipity threshold, the less likely serendipity is to occur. This is based on the principle that on the one hand the more alike a community is the lower their individual k-scores need to be as a result of groupthink, meaning serendipity is less likely. On the other hand, the more different a community is the less likely there are to be opportunities for serendipity to occur.

The serendipity threshold (k=0.98) in Equation 10 could be replaced with the intellectualisation threshold of 1.118 or the rationalisation threshold of 1.21, which in the case of the former would mean if M_c was at the serendipity threshold (k=0.98) the community would have a collective score of an average actor (k=0.81) or in the case of the latter would mean they would be exceeding their collective limits (k=1.14) as the optimal k-score for the human race would be 1 if the human brain had evolved to meet homomagnus equilibrium, but it is presently 0.81 in most people because it usually meets the Nash equilibrium where the remaining 0.19 accounts for factors like distrust and inability to resolve competing interests.

Achieving a k-score of 1 would mean a person would in effect be on autopilot and providing their cognitions are configured to act in their own interests at the same time as considering those of others then the homomagnus equilibrium could be maintained. However, in most cases where an actor experiences the homomagnus equilibrium of a knol of 1 it will be short lived, such as being briefly experienced after a moment of serendipity, where knol is 0.98.

$$`k = \left(\frac{\hat{S}k}{k_{Sa}} \right)$$

Equation 11. Probability of Seduction (Šk) for an actor (k_{Sa}) based on probability of Serendipity (Ŝk)

Equation 11 presents an formula for measuring the probability of seduction (Šk) in a given situation for a given actor (k_{Sa}) based on their k-score in that situation within the community of which they are part, which is computed in Equation 9 and Equation 10 (Bishop & Goode, 2021). The difference between seduction and serendipity is that the former tried to generate the same experiences as the latter, but the latter occurs by chance whereas the former occurs intentionally, usually by a party other than the one experiencing serendipity.

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$$\grave{k} = \left(\frac{\left(\frac{\sum_{S=1}^{N_C} \frac{k_S}{N_C}}{\hat{S}t} \right)}{k_{Sa}} \right)$$

Equation 12. A model for supporting 'serendipity engineering for seductive hypermedia' and 'user analysis using socialnomics'

Equation 12 combines Equation 9 to Equation 11 for calculating seduction (Šk) and introduces a new variable of serendipity threshold (Ŝt), which can be either 0.98 or another value as required, such as the intellectualisation threshold of 1.118 or the rationalisation threshold of 1.21 (Bishop & Goode, 2021). It can be seen that the k-score value produced by the parametric user model (Equation 8) is included twice. In the first instance as k_S it is included as part of the computation of the Mean k-scores for a given community (N_c) and on the second occasion as k_{Sa} it is included to refer to a specific actor being studied, such as a specific online community member being investigated by a clinical psychologist. Equation 12 therefore computes the probability of a specific actor being seduced into experiencing a feeling of serendipity, which is intentional and not by chance and thus is not actual serendipity even if it feels the same. However, it has been argued that linking serendipity to chance is only part of understanding it as a "plot" (De Rond, 2014). Such information can assist in assessing the risk of a given actor being drawn into situations that might feel desirable but would cause them harm, including the development of compulsive behaviours leading to digital addiction. To detect digital addiction a clinical psychologist could use the TIWWCHNT-20 scale (Bishop, 2014; Bishop, 2017) for determining phantasies and the digital addiction checklist (Bishop, 2015) for determining fantasies. By assisting with a diagnosis, a clinical psychologist can be of great assistance to an actor in managing their health (Fan, Lin, & Lin, 2015).

$$\grave{k}_{ag} = \left(\frac{100}{\left(median\left(\hat{S}k_C \right) \right)} \right) * \breve{S}k_o \,.$$

Equation 13. Computing an actor's (a) higher order (g) Serendipity (Šk) probability (Škag) towards an artefact (o) based on median of organic Serendipity (Šk) responses to an object ($_o$) within a group ($_C$)

$$median(a) = \frac{a\left[\#x + 1 \div 2\right] + a\left[\left(\#x + 1\right) \div 2\right]}{2}$$

Equation 14. Equation for calculating median (Courtesy: Wikimedia Foundation)

Equation 13 (Bishop & Goode, 2021) is used along with Equation 14 (Bishop & Goode, 2021) to compute the higher order thinking required to determine how able someone is to take advantage of a serendipitous event.

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IMPLICATIONS AND FUTURE RESEARCH DIRECTIONS

Discussion

This chapter expends the application of the ecological cognition framework to serendipity engineering, seductive hypermedia, user analysis and socialnomics. It updates the theory to better account for the advances in computational science computational intelligence. In terms of 'serendipity engineering for seductive hypermedia,' the chapter looks at how to design information systems to account for the pleasant occurrences that happen in offline environments studied by those in sales and marketing where beneficial outcomes often occur by chance encounters. In terms of 'user analysis using socialnomics,' it looks at how a parametric user model based on the ecological framework can be used to understand users of information systems. To do this number of socialnomics equations based on the parametric user model are explored, including to calculate probability of seduction and probability of serendipity in an information system. The parametric model presented has great applicability for information and communications technology solution providers.

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ANNEX 1: TABLES FOR CALCULATING THE CONVERSION OF COGNITIONS INTO PHANTASIES

This annex presents tables for calculating phantasies (p_i), which are a core part of the parametric user model (Bishop & Goode, 2021).
Table 7 is for converting goals and other cognitions into phantasies and fantasies (Bishop & Goode, 2021). Goals run from 1 to 9, phantasies from -5 to +5 and fantasies from -2.5 to 2.5, meaning the conversion variable for a phantasy is half that for a fantasy. A goal that is perceived as external to an actor is called a strategy.

Table 7. Compound identity – Converting goals and other cognitions into phantasies

Signifier Representation	Reducer	Signification Internal Representation	Reducer	Signified External Representation	Reducer	Shifter	Transformer
x / x_{4S}	$x_1 / \breve{Ca}_{eS}$	y / y_{2a}	$y_1 / \breve{Cb}_{eS}$	z / z_{3S}	$z_2 / \breve{Cb}_{dS}$	$\breve{z} / \breve{Cc}_{eS}$	$c / c_{1eS} / 2c_{1dS}$
Goal	0	Goal	0	Strategy	0	41	8
Goal	0	Plan	3	Method	3	23	4.4
Goal	0	Value	0	Rule	0	18.5	3.5
Goal	0	Belief	4	Meme	4	32	6.2
Goal	0	Interest	0	Amity	0	45.5	8.9
Goal	0	Detachment	1	Enmity	1	27.5	5.3

Table 8 is for converting plans and other cognitions into phantasies and fantasies (Bishop & Goode, 2021). Plans run from -2 to 2, phantasies from -5 to +5 and fantasies from -2.5 to 2.5, meaning the conversion variable for a phantasy is half that for a fantasy. A plan that is perceived as external to an actor is called a method.

Table 8. Compound identity – Converting plans and other cognitions into phantasies

Signifier Representation	Reducer	Signification Internal Representation	Reducer	Signified External Representation	Reducer	Shifter	Transformer
x / x_{4S}	$x_1 / \breve{Ca}_{eS}$	y / y_{2a}	$y_1 / \breve{Cb}_{eS}$	z / z_{3S}	$z_2 / \breve{Cb}_{dS}$	$\breve{z} / \breve{Cc}_{eS}$	$c / c_{1eS} / 2c_{1dS}$
Plan	3	Goal	0	Strategy	0	23	4.4
Plan	3	Plan	3	Method	3	13	2.4
Plan	3	Value	0	Rule	0	10.5	1.9
Plan	3	Belief	4	Meme	4	18	3.4
Plan	3	Interest	0	Amity	0	25.5	4.9
Plan	3	Detachment	1	Enmity	1	18	3.4

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Table 9 is for converting values and other cognitions into phantasies and fantasies (Bishop & Goode, 2021). Values run from 1 to 4, phantasies from -5 to +5 and fantasies from -2.5 to 2.5, meaning the conversion variable for a phantasy is half that for a fantasy. A value that is perceived as external to an actor is called a rule.

Table 9. Compound identity – Converting values and other cognitions into phantasies

Signifier Representation	**Reducer**	**Signification Internal Representation**	**Reducer**	**Signified External Representation**	**Reducer**	**Shifter**	**Transformer**
x / x_{4S}	x_1 / $C\breve{a}_{eS}$	y / y_{2a}	y_1 / $C\breve{b}_{eS}$	z / z_{3S}	z_2 / $C\breve{b}_{dS}$	$\breve{z}$ / $C\breve{c}_{eS}$	c / c_{1eS} / $2c_{1dS}$
Value	0	Goal	0	Strategy	0	18.5	3.5
Value	0	Plan	3	Method	3	10.5	1.9
Value	0	Value	0	Rule	0	8.5	1.5
Value	0	Belief	4	Meme	4	14.5	2.7
Value	0	Interest	0	Amity	0	20.5	3.9
Value	0	Detachment	1	Enmity	1	14.5	2.7
Value	0	Faith	1	Illusion	1	4.5	0.7
Value	0	Ardour	2	Delusion	2	4.5	0.7

Table 10 is for converting beliefs and other cognitions into phantasies and fantasies (Bishop & Goode, 2021). Beliefs run from -3 to +3, phantasies from -5 to +5 and fantasies from -2.5 to 2.5, meaning the conversion variable for a phantasy is half that for a fantasy. A belief that is perceived as external to an actor is called a meme.

Table 10. Compound identity – Converting beliefs and other cognitions into phantasies

Signifier Representation	**Reducer**	**Signification Internal Representation**	**Reducer**	**Signified External Representation**	**Reducer**	**Shifter**	**Transformer**
x / x_{4S}	x_1 / $C\breve{a}_{eS}$	y / y_{2a}	y_1 / $C\breve{b}_{eS}$	z / z_{3S}	z_2 / $C\breve{b}_{dS}$	$\breve{z}$ / $C\breve{c}_{eS}$	c / c_{1eS} / $2c_{1dS}$
Belief	4	Goal	0	Strategy	0	32	6.2
Belief	4	Plan	3	Method	3	18	3.4
Belief	4	Value	0	Rule	0	14.5	2.7
Belief	4	Belief	4	Meme	4	25	4.8
Belief	4	Interest	0	Amity	0	35.5	6.9
Belief	4	Detachment	1	Enmity	1	21.5	4.1
Belief	4	Faith	1	Illusion	1	7.5	1.3
Belief	4	Ardour	2	Delusion	2	7.5	1.3

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Table 11 is for converting interests and other cognitions into phantasies and fantasies (Bishop & Goode, 2021). Interests run from 1 to 10, phantasies from -5 to +5 and fantasies from -2.5 to 2.5, meaning the conversion variable for a phantasy is half that for a fantasy. An interest that is perceived as external to an actor is called an amity.

Table 11. Compound identity – Converting interests and other cognitions into phantasies

Signifier Representation	Reducer	Signification Internal Representation	Reducer	Signified External Representation	Reducer	Shifter	Transformer
x / x_{4S}	x_1 / $C\breve{a}_{eS}$	y / y_{2a}	y_1 / $C\breve{b}_{eS}$	z / z_{3S}	z_2 / $C\breve{b}_{dS}$	$\breve{z}$ / $C\breve{c}_{eS}$	c / c_{1eS} / $2c_{1dS}$
Interest	0	Goal	0	Strategy	0	45.5	8.9
Interest	0	Plan	3	Method	3	25.5	4.9
Interest	0	Value	0	Rule	0	20.5	3.9
Interest	0	Belief	4	Meme	4	35.5	6.
Interest	0	Interest	0	Amity	0	50.5	9.9
Interest	0	Detachment	1	Enmity	1	35.5	6.9
Interest	0	Faith	1	Illusion	1	10.5	1.9
Interest	0	Ardour	2	Delusion	2	10.5	1.9

Table 12 is for converting detachments and other cognitions into phantasies and fantasies (Bishop & Goode, 2021). Detachments run from 0 to 6, phantasies from -5 to +5 and fantasies from -2.5 to 2.5, meaning the conversion variable for a phantasy is half that for a fantasy. A detachment that is perceived as external to an actor is called a enmity.

Table 12. Compound identity – Converting detachments and other cognitions into phantasies

Signifier Representation	Reducer	Signification Internal Representation	Reducer	Signified External Representation	Reducer	Shifter	Transformer
x / x_{4S}	x_1 / $C\breve{a}_{eS}$	y / y_{2a}	y_1 / $C\breve{b}_{eS}$	z / z_{3S}	z_2 / $C\breve{b}_{dS}$	$\breve{z}$ / $C\breve{c}_{eS}$	c / c_{1eS} / $2c_{1dS}$
Detachment	1	Goal	0	Strategy	0	32	6.2
Detachment	1	Plan	3	Method	3	18	3.4
Detachment	1	Value	0	Rule	0	14.5	2.7
Detachment	1	Belief	4	Meme	4	25	4.8
Detachment	1	Interest	0	Amity	0	35.5	6.9
Detachment	1	Detachment	1	Enmity	1	25	4.8
Detachment	1	Faith	1	Illusion	1	7.5	1.3
Detachment	1	Ardour	2	Delusion	2	7.5	1.3

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Table 13 is for converting faiths and other cognitions into phantasies and fantasies (Bishop & Goode, 2021). Faiths run from Null (0) to 5, phantasies from -5 to +5 and fantasies from -2.5 to 2.5, meaning the conversion variable for a phantasy is half that for a fantasy. A faith that is perceived as external to an actor is called an illusion.

Table 13. Compound identity – Converting faiths and other cognitions into phantasies

Signifier Representation	Reducer	Signification Internal Representation	Reducer	Signified External Representation	Reducer	Shifter	Transformer
x / x_{4S}	x_1 / $C\breve{a}_{eS}$	y / y_{2a}	y_1 / $C\breve{b}_{eS}$	z / z_{3S}	z_2 / $C\breve{b}_{dS}$	$\breve{z}$ / $C\breve{c}_{eS}$	c / c_{1eS} / $2c_{1dS}$
Faith	1	Goal	0	Strategy	0	9.5	3.4
Faith	1	Plan	3	Method	3	5.5	1.8
Faith	1	Value	0	Rule	0	4.5	1.4
Faith	1	Belief	4	Meme	4	7.5	2.6
Faith	1	Interest	0	Amity	0	10.5	3.8
Faith	1	Detachment	1	Enmity	1	7.5	2.6
Faith	1	Faith	1	Illusion	1	2.5	0.6
Faith	1	Ardour	2	Delusion	2	4.5	1

Table 14 is for converting ardours and other cognitions into phantasies and fantasies (Bishop & Goode, 2021). Ardours run from -1 to Null (0), phantasies from -5 to +5 and fantasies from -2.5 to 2.5, meaning the conversion variable for a phantasy is half that for a fantasy. An ardour that is perceived as external to an actor is called a delusion. A faith phantasy, however, runs from 0 to 5, and a faith fantasy from 0 to 2.5. A ardour phantasy runs from 0 to -5 and a ardour fantasy from 0 to -2.5.

Table 14. Compound identity – Converting ardours and other cognitions into phantasies

Signifier Representation	Reducer	Signification Internal Representation	Reducer	Signified External Representation	Reducer	Shifter	Transformer
x / x_{4S}	x_1 / $C\breve{a}_{eS}$	y / y_{2a}	y_1 / $C\breve{b}_{eS}$	z / z_{3S}	z_2 / $C\breve{b}_{dS}$	$\breve{z}$ / $C\breve{c}_{eS}$	c / c_{1eS} / $2c_{1dS}$
Ardour	2	Goal	0	Strategy	0	1	-3.4
Ardour	2	Plan	3	Method	3	1	-1.8
Ardour	2	Value	0	Rule	0	1	-1.4
Ardour		Belief	4	Meme	4	1	-2.6
Ardour	2	Interest	0	Amity	0	1	-3.8
Ardour	2	Detachment	1	Enmity	1	1	-2.6
Ardour	2	Faith	1	Illusion	1	1	-0.6
Ardour	2	Ardour	2	Delusion	2	1	-1

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Chapter 7
The Role of Social Media on Young Online Consumer Behavior

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ABSTRACT

The main aim of this study is to analyze the use of social networks by young consumers and understand if they engage with brands online and if creative brand content impacts social network users and online shoppers. With the technological advances and intense use of smartphones, firms should consider connecting and standing out with their audience online. Implementing a specific social strategy on social media may be the way to go. This research uses a quantitative methodology with a survey questionnaire from Portuguese brand consumers. The results show that a creative social marketing strategy through a strong brand identity can positively affect clients if people use social media for entertainment.

INTRODUCTION

Internet has grown to be a big part of people's lives; it is typical for people to sign up and use several social networks, such as Instagram, Twitter, Facebook or WhatsApp (Sabermajidi et al., 2019). People's reasons for using them have been divided in "Entertainment, Integration and Social Interaction, Personal Identity, and Information" (Buzeta et al., 2020, p. 80). Moreover, this paper aims to understand the main reason for its use.

Suppose people are introducing the internet into their lives. Online stores are gaining notice from traditional, they can overcome immobile problems as regional situations or quickly reach markets beyond borders; however, physical stores have the advantage of face-to-face service and product display. This study will analyze how generation Z, people born from 1996 to 2010, an ageing sector that has been

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surrounded by digital devices and social media most of their life (Monaco, 2018), that represented 15% of the Portuguese population (United Nations, 2019), have engaged in e-commerce and if social media advertising has a big impact on them.

Innovation is seen as creativity applied to different sectors, for instance, a new technological approach, entering a new market segment, new materials and all that leads to a new product. Hence, creativity is the creation of new and original ideas. At the same time, innovation is used in the processes following that idea, which in this study is not what the company is selling but how they act, communicate and share online (Névoa, 2019).

The concept of e-commerce has been evolving for many years. Still, the general idea is to allow organizations to have a borderless, easy, and safe way for clients to access and buy their products from their computers or phones, over time e-commerce gained importance because it builds a competitive advantage (Dahbi & Benmoussa, 2019). Portuguese e-commerce has been getting interesting because people consume more online due to online trust. Many businesses are taking their online space to strengthen their connection to the customer and overcome the pandemic challenges (INE 2020).

We intend to study whether a brand's creative online content influence the shopping patterns of young consumer online (which means understanding the level of brand engagement that businesses obtain with their online marketing) and if creativity raises brand engagement (which essentially is the connection and interaction between brand and customer that results in a reaction on the customer) (Osei-Frimpong et al., 2018). On the brand engagement note, this study explores the level of following engagement towards brands on social platforms (Pentina et al., 2018).

THEORETICAL BACKGROUND

Brand

Concept

The brand surrounding an organization involves many aspects that define what they sell, such as the name, logo, design characteristics, which have in consideration the consumer's needs and, as a result, builds brand equity (Jeon, 2017). A brand should be coherent and consistent in what it represents to establish marketing strategies as campaigns or even a concept revolving around it that can be abstract as power, for example (Cai & Mo, 2018).

The ultimate idea of branding is to build brand loyalty, that is, having reoccurring clients that buy and recommend the brand; these customers are not affected by the market's competitors efforts (Bozbay, 2020). Nevertheless, if advertising or even organization ways to operate are incompatible with the brand image created, this may have a disruptive effect on consumers of a product or service (Allman et al., 2016). Therefore, brands' policies need to be harmonious with their responsibilities; branding must be attaching it to their culture and behaviour, so when the experience is on the requested level, it can lead the organization to a competitive advantage (van den Berg & Pietersma, 2015).

According to Kotler (2003), organizations must understand the market they are involved in by researching and focusing on the attractiveness of each factor and, subsequently, developing a marketing plan. Product, price, place and promotion are the aspects that help a brand find its strategic game in the market. Its general idea is that every marketing idea must consider all the aforementioned factors

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(Kotler, 2003). Prior studies conclude that when designing a solid brand, its characteristics must come across through advertisement, social media, visual aids in-store, packaging, in sum through every way of interaction that allows the customer to experience what a company is on paper (Ruão, 2002).

Brand Identity

According to Aaker (1996), a brand must compare its identity to a person. A definition of what they represent, their values and their mission; it is also relevant that these aspects focus on the future and are set towards a goal; in a nutshell, establishing an identity helps the organization develop solid strategies.

A brand may lose its place when lacking identity, so it must transmit a feeling with correlation to the product that is linked to its vision and values while having a memorable image that the customer can identify and relate such as a letter font, a sign, colours, or even an idea connected to a company or its' product/service (Raslan, 2014). The brand image and identity must be aligned to spread a story, especially online, successfully. Over time, analyze what is working next to the audience, change communication methods, or involve new aspects for a competitive benefit (Ranfagni et al., 2021).

There is no problem in re-evaluating the image you project with your branding at some point in your life; naturally, sometimes people rediscover themselves, which goes for business (Mazzoleni, 2013).

Hence, "The best stories are easy to share, memorable, have meaning and are authentic. Meaning is a campfire for everyone to rally around." (Mazzoleni, 2013, p.56). Alina Wheeler reveals that storytelling is essential and helps create a visual language for many levels of the company's communication and design.

According to Dash et al. (2021), ultimately, it is a solid strategy to invest in brand identity. An organization controls what to project onto its target audience, raising satisfaction levels and buying intent. This scholar complements that even though it is a multi-dimensional concept including personality, image, quality, awareness, and cultural elements, it will help analyze what clients associate with a product.

We can establish that brand identity has a good impact on a company, both management wise and client wise while useful to assess its effects on the target audience by the image created from brand identity procedures; the market is increasingly more competitive and it is harder to keep up and conquer clients over (Raslan, 2014).

Brand Positioning

The increasing competitiveness is transversal to several markets. It is happening rapidly due to globalization and technological advances, which justify the need for a strong positioning, creating your place to survive. One of the first steps should be understanding the brand's audience and establishing a competitive strategy; the brand should identify and select the segment incidence (Mourad & Serralvo, 2018).

It is essential to incorporate the branding principles, so when the company has established their mission, vision, and values they wish to pass onto the final consumer, also what makes the customer connect with the brand and what it represents, this building on their identity will help to have a good place in the market (van den Berg & Pietersma, 2015). This means that positioning is more about what happens in the customer's mind than the item being sold to gain competitive advantage and differentiate the brand (Saqib, 2020).

The strategies for positioning the brand in a competitive market must contain criteria such as defining what the market wants and needs, recognising the competitors strong and weak aspects and thinking

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about how to overcome these aspects as well as passing their message, values, what they represent and creating a feeling in the customer (Mourad & Serralvo, 2018).

Branding and identity are essential, but a brand should also have a sustainable strategy, so the business is profitable because some strategies are not viable such as fake information on the product's characteristics or targeting a niche that does not purchase as expected (Swani, 2015).

E-Commerce

Concept

E-commerce is the "trading of goods or services over computer networks such as the Internet", it opens the market because it allows brands with an online presence to expand internationally without moving even though there are several strategic plans to ponder (Hånell et al., 2019).

The evolution of technology has caused the development of businesses, with changes in the models, products, strategy and overall, it is a sign of innovation while social and cultural traits are gaining importance in entrepreneurship (Reuschke et al., 2021). Now, global companies, customer-focused shops and small online businesses are sharing the spotlight, making the online sector a growing competitive market, so it becomes a challenge to attract clients and stand out (Kuo, 2019).

The pandemic has affected all businesses, especially with the mandatory lockdown that did not allow either customers or shop owners to go out or stay open. Thus, previous face-to-face businesses had to convey in digital ways to reach clients and, of course, sell online (Reuschke et al., 2021).

According to Haryanti and Subriadi (2020), this technology allows people to purchase their items, from anywhere quickly, no matter the time, with a safe and straightforward payment process; these characteristics made businesses adopt e-commerce and grow worldwide. Thus we can agree that shopping online is easy and comfortable. Still, it also changed competition patterns because one can switch to another page or compare every detail of a product with many other offers at the distance of a click. These scholars agree that e-commerce is not the recipe for business perfection, and some companies fail to keep up while others thrive, forming new ways to affirm their position. We should also address that entering an e-commerce culture is challenging mainly because of the customer's lack of knowledge and apprehension in discussing details online (Dahbi & Benmoussa, 2019).

A simple, appealing and well-designed website oriented for e-commerce is a powerful advantage for digital brands as for their sales. This should be to display offers and conduct payments, even if the brand is present in other channels such as social networks; that being said, for the company's management is also useful to analyze and measure the costumers' needs (Carvalho & Mamede, 2018).

Adding to the reasons to invest in e-commerce is that people stay many hours on their phones, significantly since these have evolved so that their use is for entertainment, education, communication, and becoming the first resource for all activities (Silva & Martins, 2016).

So, innovation has deeply influenced the popularity that e-commerce has gained over the years because it facilitated the process making it more appealing than offline shopping, where people deal with travel, traffic, parking, queues and stress (Dastidar et al., 2020). These authors express the influence of safe online payment methods and Chatbots, a virtual customer service, on the transition to an e-commerce preference.

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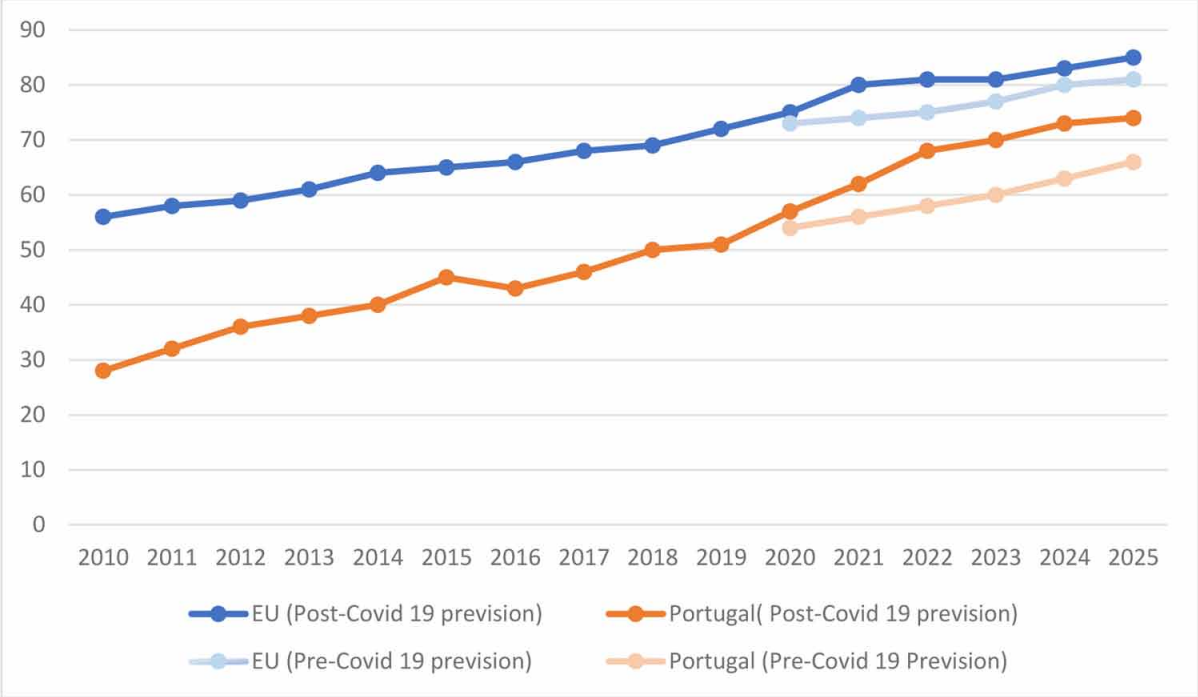
Offline or online, promotional marketing is a strategy that has proven itself promoting discounts and campaigns is a good bet when working with e-commerce. A company that offers free shipping policies can increase clients interest and raise brand loyalty (Zhao et al. 2020).

The Covid-19 crisis has caused corporations to be resilient and innovative; we can see that in the shift to the online world and its efforts to stay close to the customer (Bressan et al., 2021).

E-Commerce in Portugal

The Covid-19 pandemic has stimulated the increase of e-commerce (Figure 1); many companies implemented promotions on delivery, inspiring people to still shop but in a safer manner while at the same price as before lockdown (Guimarães, 2020).

Figure 1. E-commerce users in Portugal
Source: ACEPI (2020, p. 7).



According to the data from ACEPI's studies, the current Covid-19 pandemic affected the numbers of e-commerce usage in 2020, with 60% of online buyers assuming to buy more and 73% of buyers are using online platforms for purchases 3 to 5 times a month.

Students and those with a college education, people from 25 to 34 years of age and currently employed, are the segments that have a more significant impact on online orders (ACEPI, 2020). More requested items are fashion and sports accessories (Pontes, 2018). Food and grocery delivery through the internet had an exponential growth because people could not go to restaurants and preferred to avoid going to the supermarkets for safety (INE, 2020).

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We focus on business to consumer e-commerce where a brand directs its service to the final consumer through the internet. Still, there are other categories, such as business to business, a process to business, consumer to consumer and, finally, business to government (Gabriel & Loredana, 2020).

Figure 2. National and International purchases
Source: ACEPI (2020, p. 11).

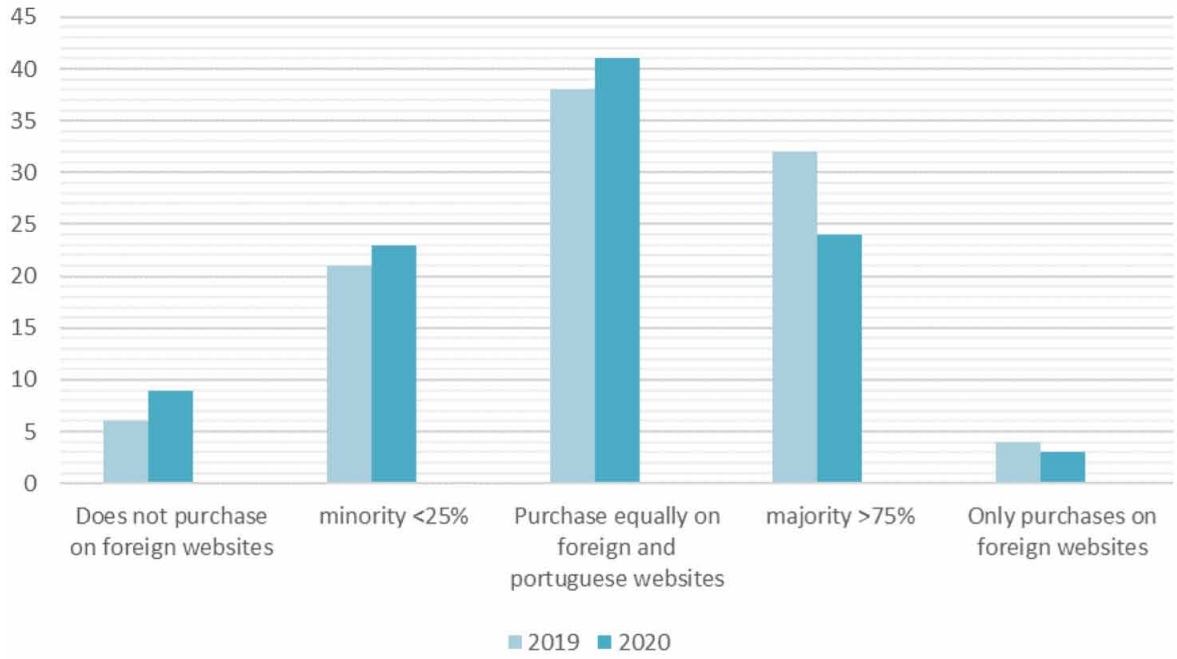


Figure 2 shows that consumers are increasingly inclined to buy in Portugal; only 3% buy from foreign brands while 9% exclusively purchase from Portuguese companies. Halfway, purchasing either one is the majority at 41%. People are ordering more from Portuguese online stores relies on the increase of physical stores adapting and creating an online channel and small businesses that their primary sales channel is through e-commerce. Also, consumers trust online shopping because of the easy payment process, information disclosure, intuitive websites, and good delivery systems, hence the expansion of Portuguese online brands (ACEPI, 2020).

It is safe to agree that online shopping in Portugal is expanding, even though it is still below the European average. It is at a favourable rate; the online retail sector alone has grown 36% due to the pandemic, which is now creating new habits for both shoppers and owners, people are getting accustomed to visiting online stores and buying from home which is shaping the preview of the online retail sector's ongoing growth for years to come (P. Marketline Industry, 2021).

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Social Media

Concept

Many significant technological advances influenced people's daily lives (e.g., press, radio or television). Still, the internet, more specifically social networks, affects our lives by making us think differently. People use these networks for conversations, commerce, information, ultimately defining their consumption habits (Sheth, 2020). One of the reasons why social media had a strong effect and adherence lies in its unique interactivity, by being able to *like, comment, share* or even create their content and receive feedback in real-time, offering a sense of connection to people from around the world (Rodgers et al., 2021). These features are Facebook, Instagram, YouTube, Pinterest, Twitter, and others (Cao et al., 2021).

People started engaging in those online platforms. It had a substantial impact on how they communicate and receive information, particularly with social networks in which people are very active nowadays using Facebook and Instagram. It grew even more with *stories* and *IGTV* features of the Instagram app, making this app the current favourite (Nafees et al., 2020). People spending many hours online has turned social media into an effective way of communicating with their customers and reaching out to new ones, leading to brand loyalty and engaging the customer (Brandão et al., 2019).

The younger audience represents a significant part of internet users for several activities such as social media and online purchases. This makes this age sector more active and demanding since they value innovation, trust, opinions, integrity, after-sales assistance; they will investigate deeply before buying (Vieira et al., 2020). Even though young people predominantly use it, the pandemic has heightened the usage of the older generation as well (Mohamad, 2020).

Online websites are the primary information centre and selling vehicle of a business, gathering their products, promotions, and intel on the brand itself (Pontes, 2018); nevertheless, social media has become the centre of marketing strategies. According to Duffett (2015), online pages help the decision process and increase people's intent-to-purchase.

Hansopaheluwakan et al. (2020) revealed that social media marketing directly influences purchase intention, confirming that it is vital to have an online strategy defined. For these scholars, businesses should see an opportunity to stay close to their clients and reach out to more than in the offline world. Social media presence has gained such importance that it created jobs in social marketing and social media managing companies (Bouwman et al., 2018). How a brand presents itself online contributes to its brand image. It is a significant part of their marketing strategies; on Instagram, information is shared through video or photos. It is vital to invest in this content to share their products and capture attention while contributing to the brand's positioning online (Teo et al., 2019).

Some scholars argue that eWOM is being replaced by sWOM (social word of mouth), even though it has similar characteristics (Ha & Thu, 2020). According to these scholars, both happening on the internet, sWOM allowed the content and shared experiences to expand beyond borders, increasing customer purchase intentions and behaviour. Additionally, sWOM contributions are the interaction between brand and client that will positively impact sales rates, for example, through online reviews (Zhao et al., 2020).

Social Media Content

Over time, marketeers recognized that it was beneficial to create content that caused a reaction, like surprise or laughter, instead of using social networks to promote and attract clients only via price

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tactics(San et al., 2020). If a product or an idea is creative is easy to evaluate because of the sharing system of social media that quickly validates the brand's posts. *Nike* is a successful example of using social media's content to enhance its brand image. This company uses it for more than selling and promoting but to create a lifestyle and connect through storytelling, making it the second most followed brand on Instagram (Li et al., 2021).

Once a company analyses its impact on social media, it will see with whom it resonates best and start creating content directly to this segment, thus connecting over a specific shared interest (Laestadius et al., 2020). The brand's social media posts must be thought through, or it may cause moral-based firestorms; in the online world, these controversies spread intensely (Scholz & Smith, 2019), leading to unfollows on those platforms, which affects the company's sales rate and reputation (Wang et al., 2020).

As stated, young people are the primary users of social media; still, this age sector is not passively using online platforms but also contributing unique creative content online, using *Tiktok* (Mohamad, 2020). Individual creativity and organizational creativity are linked because the employees' creative abilities and reflection on their job performance will influence the capability of an organizational to innovate (Amabile, 1988). Furthermore, a business should implement an entrepreneurial orientation to motivate creative thinking into new products or business practices to enter a new place, such as social networks (Ferreira et al., 2020).

Moreover, a social content strategy involves assuming a message through functional and emotional appeals, interactivity, inspirational and trendy subjects, user acceptable and attractive content while advertising the benefits of choosing the brand's product; a popular strategy is approaching people with a significant impact on social media to influence others with their online solid opinion and visibility in favour of the brand in question (Li et al., 2021). The content exposed can be one of three categories: (1) rational related to direct information, (2) interactional that is more personal and builds a client-brand relationship, and (3) transactional related to promotion and sales focused (Shahbaznezhad et al., 2021). This scholar finds that emotional and entertaining posts work best in the form of video leading to reactions (comments) online.

When receiving this virtual information, there are different levels of engagement, one of which is *connection* where a user chooses to see a brand's content by *following* or putting a *like* on their posts (Shawky et al., 2020). This author explains that this might be the lowest level of engagement. Still, if a person follows the brand, its content will appear every time it is posted to be present on the client's mind increasing purchase intent, which is very positive for a business.

A business can have many advertising channels, and it is critical to create brand awareness. Thus, it is easy to identify and remember a brand on any platform. This can be achieved by having a straightforward message that connects the brand to their product/service; having a unique symbol and repeating its use, memorable jingles; using these techniques allows people to recognize a brand anywhere (Wibowo et al., 2020).

In the competitive online market, brands can distinguish themselves with unique products or a unique form of communication in their SNS's (Roggeveen et al., 2021).

METHODOLOGY

A quantitative approach was used to reach out to the younger generation and analyse the information received on their personal and relevant response on the topic.

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This study will be conducted by a quantitative method to gain insight into the subject by retrieving information, evaluating it, and presenting statistics on the matter (Saunders et al., 2009). Starting from e-commerce usage, understanding social media usage and, finally, exploring what stands for creative content.

Therefore, we intend to research social media's role, gather responses, treat the presented data, and ultimately verify what constitutes creative content and analyze young people's behaviour.

Sample and Data Collection

To approach the target audience of this study, we developed an online questionnaire, for it is the fastest way to reach young people from several points of Portugal, even though it is open to people from 14 to over 45 years old. The questionnaire was created on *Google forms,* and it was shared on Facebook and Instagram, for two weeks, from 31/05/2021 until 14/06/2021. People answered to it anonymously, and since it was directed at younger people on these platforms, it was, more specifically, shared in university groups and re-shared by students for a more extensive reach.

We were able to gather 123 answers, which will be our sample for the present study, which is not representative of the population of Portugal.

It is a simple and quick survey, and it has two parts. The first is for personal identification and exploring social media and online shopping usage. If a person does not use the internet to purchase items, the inquiry ends here; the second bit evaluates the level of accordance to affirmations made about the topics, ending with an open question.

Measures

We intend to analyze these measures: a) the use intention, it has been established that people use social media so, with this study, we want to look at the importance of each intention (information, entertainment, communication) (Silva & Martins, 2016); b) the *following* engagement level, it is the lowest level of engagement with a brand however it gives as insight in whether or not social media advertising is reaching people (Pentina et al., 2018); c)the need for uniqueness, this measurement is subjective to the eye of the online user for which social media content is creative and, therefore, stands out for said brand to be mentioned in the questionnaire(Hyun & Park, 2016).

To measure the level of responses on the topic, in the second part of the survey, we used a 5-point Likert scale (1 – totally disagree; 5 – totally agree) (Nemoto & Beglar, 2014).

Results

Reliability Analysis

This study collected 123 answers and will be analyzed throughout the paper.

To analyze the consistency and reliability of the data collected, an Alfa de Cronbach analysis was conducted, which is universally accepted for the metric study of any scale and has been understood as providing "reliable prospects". This test estimates the reliability of the answers from a questionnaire through a scale that implies tool stability. To evaluate the trustworthiness of the sample, we chose a

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scale suggested by Pestana and Gageiro (2008). It is expected that the result of this analysis is positive, likely shifting between 0 and 1.

From Table 2, it is possible to verify that the trustworthiness of the sample is very good for the total amount of variables.

Table 1. Trustworthiness statistics

Alfa Cronbach	N. of items
0.739	144

Source: Own elaboration.

Descriptive Analysis

About the age factor, we can see that 58.0% of the respondents have ages from 19 to 25 years old, 15.3% between 26 and 35 years old, 7.6% between 36 and 45 years old, 6.9% from 14 to 18 and 6.1% are over 45 years of age. 6.1% did not answer this question.

Table 2. Age

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	14-18	9	6.9	7.3	7.3
	19-25	76	58.0	61.8	69.1
	26-35	20	15.3	16.3	85.4
	36-45	10	7.6	8.1	93.5
	> 45	8	6.1	6.5	100.0
	Total	123	93.9	100.0	
Omission	System	8	6.1		
Total		131	100.0		

Source: Own elaboration.

The table below shows that 62.6% of the respondents identified as the feminine gender, 29.8% with the masculine gender (Table 4).

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Table 3. Gender

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	1	82	62.6	66.7	66.7
	2	39	29.8	31.7	98.4
	3	2	1.5	1.6	100.0
	Total	123	93.9	100.0	
Omission	System	8	6.1		
Total		131	100.0		

Source: Own elaboration.

This study shows 41.2% of the collaborators have a bachelor's degree, 26.7% have a high school diploma and 16.0% have a master's degree (Table 5).

Table 4. Educational qualifications

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Middle school	5	3.8	4.1	4.1
	High school	35	26.7	28.5	32.5
	Bachelor	54	41.2	43.9	76.4
	TeSP	7	5.3	5.7	82.1
	Master	21	16.0	17.1	99.2
	PhD	1	.8	.8	100.0
	Total	123	93.9	100.0	
Omission	System	8	6.1		
Total		131	100.0		

Source: Own elaboration.

When questioned on which social networks people use, *Instagram* stands out with 92.7% followed by *Facebook* with 83.7% of the respondents using it, 43.1% use *Pinterest*, 42.3% use *Twitter* whilst only 0.8% use *Google Plus*. However, 33.3% use other social networks that were not listed (Table 6).

Table 5. Social networks

Social Network	Frequency	Percentage
Instagram	115	92.7%
Facebook	103	83.7%
Pinterest	54	43.1%
Twitter	53	42.3%
Others	41	33.3%
Google Plus	1	0.8%

Source: Own elaboration.

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As for the time spent on social networks, Table 7 reveals that 57.3% dedicates 1 to 3 hours of their time to it.

Table 6. Time spent daily on social networks

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	> 1 hour	18	13.7	14.6	14.6
	1-3 hours	75	57.3	61.0	75.6
	> 3	30	22.9	24.4	100.0
	Total	123	93.9	100.0	
Omission	System	8	6.1		
Total		131	100.0		

Source: Own elaboration.

87.8% of responses were positive on using the internet to purchase items, only 12.2% do not engage in online shopping.

Table 7. Use of the internet for purchases

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Yes	108	82.4	87.8	87.8
	No	15	11.5	12.2	100.0
	Total	123	93.9	100.0	
Omission	System	8	6.1		
Total		131	100,0		

Source: Own elaboration.

The majority (55.0%) of those who shop online have affirmed to do it monthly.

Table 8. Online shopping frequency

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Weekly	11	8.4	10.2	10.2
	Monthly	72	55.0	66.7	76.9
	Annually	25	19.1	23.1	100.0
	Total	108	82.4	100.0	
Omission	System	23	17.6		
Total		131	100.0		

Source: Own elaboration.

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There are several types of items that are available for purchase online, so about it, we gathered that 72.2% of the sample buy clothing items online, followed by technology products (47.2%) and art items being the less purchased (0.8%) (Table 10).

Table 9. Types of items purchased online

Items purchased online	Frequency	Percentage
Clothing	89	72.2%
Technology	59	47.2%
Take-away food	53	42.6%
Other	49	39.8%
Sport items	31	25.0%
Second-hand items	15	13.9%
Groceries	14	11.1%
Art	9	0.8%

Source: Own elaboration.

Table 11 shows that 77.1% agree (64.1% totally agree and 13.0% agree) about using social networks for entertainment purposes.

Table 10. Use of social networks for entertainment

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	Totally disagree	1	.8	.9	.9
	Neither agree nor disagree	6	4.6	5.6	6.5
	Agree	17	13.0	15.7	22.2
	Totally agree	84	64.1	77.8	100.0
	Total	108	82.4	100.0	
Omission	System	23	17.6		
Total		131	100.0		

Source: Own elaboration.

About its use as an information resource, 61.1% say they agree about this purpose of usage (39.7% totally agree and 21.4% agree) (Table 12).

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Table 11. Use of social networks for information

		Frequency	Percentage	Valid percentage	Cumulative Percentage
Valid	1	2	1.5	1.9	1.9
	2	6	4.6	5.6	7.4
	3	20	15.3	18.5	25.9
	4	28	21.4	25.9	51.9
	5	52	39.7	48.1	100.0
	Total	108	82.4	100.0	
Omission	System	23	17.6		
Total		131	100.0		

Source: Own elaboration.

Regarding whether people engage with brands online by following them on social media, 46.6% follow up with brands online (31.3% totally agree and 15.3% agree). In comparison, 21.4% do not agree with this (Table 13).

Table 12. Brand following on social networks

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	1	11	8.4	10.2	10.2
	2	17	13.0	15.7	25.9
	3	19	14.5	17.6	43.5
	4	20	15.3	18.5	62.0
	5	41	31.3	38.0	100.0
	Total	108	82.4	100.0	
Omission	System	23	17.6		
Total		131	100.0		

Source: Own elaboration.

37.5% agree that the objective of following brands online is to learn about sales and promotions (26.0% totally agree and 11.5% agree). However, 29% do not think positively about it (Table 14).

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Table 13. Brand following to learn about sales/promotions

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	1	22	16.8	20.4	20.4
	2	16	12.2	14.8	35.2
	3	21	16.0	19.4	54.6
	4	15	11.5	13.9	68.5
	5	34	26.0	31.5	100.0
	Total	108	82.4	100.0	
Omission	System	23	17.6		
Total		131	100.0		

Source: Own elaboration.

As stated above, it is common for people to follow brand on social media but while questioning if these brands they follow are brand that people have bought from before only 12.3% agreed (9.2% totally agree and 3.1% agree) to this sentence. In comparison, 51.2% disagreed (26.0% totally disagree and 25.2 disagree).

Table 14. Only following brands from whom have purchased before

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	1	34	26.0	31.5	31.5
	2	33	25.2	30.6	62.0
	3	25	19.1	23.1	85.2
	4	4	3.1	3.7	88.9
	5	12	9.2	11.1	100.0
	Total	108	82.4	100.0	
Omission	System	23	17.6		
Total		131	100.0		

Source: Own elaboration.

Most people from the sample, 52.7%, value online opinions on brands (29.8% totally agree and 22.9% agree), while 4.6% have no consideration for it (Table 16).

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Table 15. Appreciation for online opinions about brands

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	1	6	4.6	5.6	5.6
	2	5	3.8	4.6	10.2
	3	28	21.4	25.9	36.1
	4	30	22.9	27.8	63.9
	5	39	29.8	36.1	100.0
	Total	108	82.4	100.0	
Omission	Sistema	23	17.6		
Total		131	100.0		

Source: Own elaboration.

On the subject of the appreciation of unique products and, consequently, brands with these kinds of products, 45.0% does value it; however, 27.5% has a neutral opinion on it (Table 17)

Table 16. Appreciation of brands with unique products

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	1	5	3.8	4.6	4.6
	2	8	6.1	7.4	12.0
	3	36	27.5	33.3	45.4
	4	30	22.9	27.8	73.1
	5	29	22.1	26.9	100.0
	Total	108	82.4	100.0	
Omission	System	23	17.6		
Total		131	100,0		

Source: Own elaboration.

Table 18 shows a substantial majority (63.4%) stated to value creative content about products on social networks.

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Table 17. Appreciation for creative content about products on social networks

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	1	4	3.1	3.7	3.7
	2	8	6.1	7.4	11.1
	3	13	9.9	12.0	23.1
	4	30	22.9	27.8	50.9
	5	53	40.5	49.1	100.0
	Total	108	82.4	100.0	
Omission	System	23	17.6		
Total		131	100.0		

Source: Own elaboration.

Regarding the open question about a brand that has creative content online, the brand *Control* stands out (17.69%), followed by *Super Bock* (7.07%), then *Nike* (4.42%) and *Adidas* and *Licor Beirão* (3.53% each). Most answers were singularly representing 43.12% in total; as examples, brands such as *Ikea*, *Samsung*, and *Zara* were mentioned. 6.19% chose not to respond.

Table 18. Brand considered to have creative content

Brands	Frequency	Percentage
Control	20	17.69%
Super Bock	8	7.07%
(No answer)	7	6.19%
Nike	5	4.42%
Adidas	4	3.53%
Licor Beirão	4	3.53%
Cider	3	2.65%
Intimissimi	3	2.65%
Coca Cola	2	1.76%
Sumol	2	1.76%
Dr.Bayard	2	1.76%
Burguer King	2	1.76%
Worten	2	1.76%
Playstation	1	0.88%
Alexander Mcqueen	1	0.88%
Kaspersky	1	0.88%
Aliexpress	1	0.88%
Marvel	1	0.88%
Pangaia	1	0.88%

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Table 18. Continued

Brands	Frequency	Percentage
A menina dos Brigadeiros	1	0.88%
Pinto e Castro	1	0.88%
Nespresso	1	0.88%
Ikea	1	0.88%
CR7	1	0.88%
My own thing	1	0.88%
Pegada Verde	1	0.88%
Netflix	1	0.88%
McDonald's	1	0.88%
Lidl	1	0.88%
Suunto	1	0.88%
Richard Ginori	1	0.88%
Motel Rocks	1	0.88%
Topseller	1	0.88%
Nipponlab	1	0.88%
Jacquemus	1	0.88%
Topissima	1	0.88%
Gisou	1	0.88%
We wore what	1	0.88%
Bershka	1	0.88%
GNR	1	0.88%
Brown	1	0.88%
TWOTHIRDS	1	0.88%
Exploressaurus	1	0.88%
Boticário	1	0.88%
Colourpop Cosmetics	1	0.88%
Shein	1	0.88%
Fnac Portugal	1	0.88%
Frutorra	1	0.88%
JeBe	1	0.88%
Bimba y lola	1	0.88%
Sound Bremer	1	0.88%
Melissa	1	0.88%
Levis	1	0.88%
Converse	1	0.88%
Zara	1	0.88%
Samsung	1	0.88%
Natura	1	0.88%

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Table 18. Continued

Brands	Frequency	Percentage
Mr. Wonderful	1	0.88%
Bordallo Pinheiro	1	0.88%
Flavers	1	0.88%
GoPro	1	0.88%
Somersby	1	0.88%

Source: Own elaboration.

DISCUSSION AND CONCLUSION

Marketing and branding are not new concepts that firms are starting to invest. However, the internet boom and, consequently, social media increase changed the way brands portrait themselves reaching out to people, either by storytelling and aligning their products with their culture or a more provocative attitude (Scholz & Smith, 2019).

Regarding creative production, the factors that resonate with the masses are still a subject of study, as *Nike* is one of the top brands in the internet world. It is the third most mentioned brand in the present study, and it creates a lifestyle idea through storytelling. As for the most mentioned brand, *Control* (17.69%), a brand of sexual aids, it is the number one brand in this field; it has both Facebook and Instagram accounts in which they share humour subjective content often. As reviewed, a factor that constitutes creativity, especially online, is humour. Note that the most mentioned brand for creative content has all posts in the Portuguese language, and their content refers to national cultural characteristics or events/celebrations, for example.

Generation Z, composed of today's young people, from ages 14 to 25, is the group that uses social media and the internet more, which aids to the question of social strategies from brands. Our study concluded that *Instagram* is the most used network. Companies can have a social strategy but, since people have several subscriptions to different platforms, one should take advantage of that and adapt its content to each platform. For instance, the feature of *stories* and *highlights* of *Instagram* can easily be viewed and shared by the interested.

77.1% of young people state that social platforms' intention is for entertainment, explaining that informative posts echo with clients, but entertaining content has more impact.

Concerning the following component, the present study gathered that most of the sample does keep up with brands on social media, one of the reasons being to keep up with promotions or sales even though 51.2% stated not only to follow brands they are clients of and have purchased. Withdrawing that a social strategy with unique digital material aligned with human values leads to sharing and creating posts, supports decision-making and brand preferences. Some examples of brands using this specific strategy are *Nike* with the hashtag #equality, Airbnb used #weaccept. There are also other means to communicate with human values, other than social causes, such as creating content threads from clients through a common hashtag. It is crucial to understand the audience, knowing their central beliefs, values, and cultural identities so people can relate and sympathize with that content (Nikolinakou & Phua, 2019).

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Following brands online completely opens access between firm and customer. Still, as people follow, they can also stop doing so, *unfollowing* them for many reasons and, with that, affecting long-term sales, even though the exact impact on it from *unfollow*ing on social media is uncertain (Wang et al., 2020).

Reviews and comments are some of the critical characteristics of social platforms. These are shared and explained by people whose accounts have an extensive range and influence on influencers, with whom brands work to share their products and experiences, promoting them. This study notes that 52.7% responded positively to valuing a second party's opinion about a brand.

The firm and the customer perspectives in a social media marketing strategy has in consideration the primary motivations, key activities, and significant outcomes from the types of SMMSs (social commerce strategy; social content strategy; social monitoring strategy; social customer relationship management strategy). About the social content strategy, this study focused on the lowest level of brand engagement, which is following online pages; however, the key activities that are expected from customers is to like, share and comment. Companies that have a strong brand identity defined, when applying the social content strategy, should be conceived carefully to connect with the viewers and generate viral and impactful content.

It is possible to see that 45% of our sample appreciate brands with unique products, and only 3.8% totally disagree on this; as well as 63.4% value creative content on social networks, which it categorizes as the need for uniqueness too because it is special, specific, attractive, creative content which has more impact if it is unique, therefore there is a need for uniqueness online, for brands to stand out not only for their products but identity, and how they pass it on.

As reviewed, e-commerce in Portugal has had exponential growth, either by people adopting this type of shopping or firms adapting to e-commerce and facilitating the process. 87.8% use the internet to buy items, and 66.7% do it monthly, so the Portuguese National Statistical Institute data is increasing quickly. Moreover, clothing and technology are what people said to buy more on the internet and take-out food and groceries that now have specific platforms and were improved due to the pandemic situation (delivery; payment functions; et cetera).

In conclusion, internet is a big part of people's and companies lives. People use it for the most diverse activities, and from this study, the intention of joining social media is in search of entertainment. Still, online people are very aware of their consumption due to the intense information flow and are getting more selective. Therefore, brand identity, cultural awareness, and creative content that fits the entertaining box are relevant factors to consider when investing in a social marketing strategy while taking advantage of the e-commerce context.

A recommendation for future work is to understand how brands can create content that is considered creative, what characteristics constitute creativity online, and how it reflects on selling rates, negatively or positively.

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KEY TERMS AND DEFINITIONS

Brand: Involves many aspects that define what companies must sell. It comprises name, logo, design characteristics, which have in consideration the consumer's needs.

E-Commerce: Electronic commerce is the trading over internet networks. It allows brands with an online presence to expand internationally without moving.

Social Media: Results from technological advances that influenced people's daily lives. Social media affects people's lives by making us think differently.

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Chapter 8
Focal Industries in Information Systems Research:
A Scientometric Approach

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ABSTRACT

Information systems is a field that is highly relevant to the business environment. As a relevant concept, industry covers businesses that might have similar problems and processes. Problems and case studies from the industry are often covered in information systems publications. Considering the relevance of the industry concept, this chapter follows a scientometric approach to examine research interest from the information systems discipline towards sectors and industries. The approach depends on the industry codes involved in publication meta-data by EBSCO. Meta-data was collected for articles published in 20 information systems journals between 1996 and 2020. The results present an overview of relevant North American Industry Classification System (NAICS) sectors for selected information systems journals, as well as the most active journals by sector. A comparison of annual publication counts is presented, and the authors highlight the trends of research interest towards sectors.

INTRODUCTION

Information Systems Research is a dynamic and ever-changing field that faces many opportunities and challenges (Straub, Boudreau, & Gefen, 2004). Baskerville and Myers (2002) defined Information Systems as an applied discipline that needs to adapt to changes in the environment and draws upon more fundamental disciplines during its development. The primary objective of Information Systems Research is to generate the knowledge to enable the application of Information Technology (IT) for organizational and managerial purposes (Hevner, 2003). In this regard, the diffusion of information technology throughout digitalization is an interesting phenomenon for IS research.

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As a discipline that relies on the role of information systems and information technology in the industrialized world (Baskerville and Myers, 2002), Information Systems is closely related to digital transformation and its effects on businesses. More generally, Information Systems relate to the adoption of IT in organizations, as well as digital technologies. As noted in the highly influential paper by Benbasat and Zmud (2003), examining ties between Information Systems with the environment is necessary to define the boundaries and identity of the Information Systems discipline. From this theoretical perspective, digital transformation in the business environment is highly relevant to Information Systems research. Furthermore, Hevner (2003) underlined the relevancy of environmental factors for theory development, and applications in the Information Systems discipline. According to the author, Information System research requires understanding the organizations and people, along with technology, that necessitates case studies, experiments, field studies, and simulations. Similarly, Benbasat, Goldstein, and Mead (1987) highlighted the case study as an essential and legitimate method for extending the body of knowledge in the Information Systems discipline in a turbulent environment where the adoption of technology implicates both organizational and technical issues.

IS research has been subject to studies that examine the publications according to their research topics, methodology, and research paradigms followed. To our knowledge, the sectoral orientation of the discipline has not been extensively discussed in prior studies. An opportunity for our research is the availability of industry-publication links in publication meta-data. EBSCO database has been listing publications (EBSCO Connect, 2018) with lists of subjects, that index keywords and industry codes according to the North American Industry Classification System (NAICS). By analyzing the frequency of industry codes provided for IS publications, this chapter examines which sectors have been revisited by IS scholars and reports the most popular industries by IS journals. In this regard, this chapter extends the prior study (Kabasakal, 2017) by examining a more extensive dataset in greater detail. Moreover, the leading journals are highlighted for each sector, considering the ratio of their sector-related publications. Our findings also visualize the intensity of annual industry-linked publications to identify the trends of sectoral orientation.

LITERATURE REVIEW

Relevance of the Business Environment for the Information Systems Research

Information Technologies transform businesses, and the Information Systems discipline is highly relevant to organizations. A business exists in an industry along with its competitors and stakeholders. According to Chiasson and Davidson (2005), every industry has characteristics that influence IT artifacts as well as IS activities performed by businesses. The authors also argued that businesses within the same industry might have similar processes, equipment, supply chain structures, outputs, and IS requirements that include the IT solutions, governance mechanisms, and capabilities in software that relate to the characteristics of the industry. According to Melville and Ramirez (2008), industries require different degrees of information processing that emerge from the differences in regulations and supply chain structures. Besides, information is a crucial input that affects competition in an industry by changing the structure of industries and creating a competitive advantage for businesses (Porter and Millar, 1985) that leverage this input. Adopting information technologies in public administration also involves organizational issues to be addressed in IS research (Cordella and Iannacci, 2010).

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The IS field has significantly progressed towards its maturation, and literature reviews are needed for IS research that presents further research opportunities for researchers (Templier and Paré, 2014). Considering the relevance of the business environment for IS discipline, we might expect to observe sector-oriented publications by IS researchers. Due to its interdisciplinary and applied characteristics, the Information Systems discipline provides a host to support research towards core industry-specific problems, such as new product development (Nambisan, 2003). Moreover, the environmental changes in the industry force businesses to use information technologies and systems more intensively (Salmeron and Bueno, 2006). This tendency is even stronger for businesses in more information-intensive environments (Thong and Yap, 1995), where IT provides significant opportunities for competition (Porter, 1990). From this perspective, it is reasonable to expect contributions of IS research for problems in various industries. In this regard, assessing the industry orientation of IS research is a significant issue that needs to be explored.

With a scientometric approach through exploring industry orientation of IS research, we use publication meta-data that manifest the relevancy of a publication with an industry. As mentioned in previous studies, Information Systems research is profoundly concerned with the organizational environment of businesses and the use of information systems in various contexts. Therefore, it is practical to use one of the industrial classification systems as a template and classify the publications accordingly and find out which sectors and industries have been addressed in IS literature.

Bibliometric Studies on Information Systems Research

There have been bibliometric studies that have investigated body of knowledge in the Information Systems research. A study by Palvia et al. (2015) examined the topics and research paradigms and reported that electronic commerce was the prominent topic in IS publications, most of which followed the positivist paradigm. Muniroh et al. (2021) identified 38 information systems-related topics that were popular in articles published in SINTA Journal between 2015 and 2019. In particular, the top-5 of this list involves the topics: “application development”, “decision support system”, “system analysis & design”, “human-computer interaction”, and “data & information management”. La Paz et al. (2020) clustered the publications in the Information Systems Journal into clusters based on their themes and presented an extensive bibliometric analysis by analyzing the origin of authors and citations across related journals. Moreover, the authors highlighted a selection of papers that had a considerable impact on the IS research agenda. A study by Chen and Hirschheim (2004) reviewed the research paradigms and research design in the Information Systems discipline. By examining publications from Europe and North America, the authors reported that 81% of published Information Systems research follows the positivist paradigm. A notable finding from this study underlines that industry-focused reviews have been found limited. Among such publications, a study by Kurnia et al. (2019) compared industries regarding the adoption of Inter-Organization Information Systems by businesses.

A study by Bloch et al. (2019) investigated the role of public-private collaboration in impact of publications, and compared that effect in several industries including health, biomedical, agriculture, fisheries, and forestry. The authors compared the count of papers co-authored with or originating from the industry. Another study by Calvert and Patel (2003) presented a bibliometric analysis that explores co-publications as “indicators of university-industry research” where their results reported top collaborating firms and universities by science fields. However, using meta-data that describes relevant industries might be a more direct approach to examine the sectoral orientation in a research field.

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There have been recent studies (Goes, 2013; Benedict, 2018) that discuss the relationship between the Information Systems Research and the environment by focusing on the "ecosystem" concept. In such studies, ecosystems have been defined as cross-industrial organizations formed by individual actors that depend on symbiotic and dynamic interactions among collaborators. On the other hand, a more rigid taxonomy would be needed as a reference that would help to investigate the evolution of sector orientation of the discipline over time. With this consideration, we refer to industry classification taxonomies that provide a useful basis to systematically describe the business environment.

Industry Classification Systems

Industry classification systems are taxonomies that have been developed by governments, transnational organizations and private organizations, designed with an emphasis on various differences such as production systems or market characteristics (Banasiewicz, 2022). Essentially, the industry classification systems are developed with the aim of grouping firms to facilitate benchmarking. As mentioned in the report by the Economic Classification Policy Committee (1994), an industry classification system reflects the structure of the economy and facilitates the use of statistical data in sampling and comparability. As noted by Kim et al. (2022), industry classification helps to categorize businesses by placing them into an industry, thereby offers benefits for researchers and practitioners. On the other hand, as noted by the authors, this process also involves challenges due to a high number of companies that enter or exit an industry.

Standard Industry Classification (SIC), North American Industry Classification System (NAICS), and Global Industry Classification System (GICS) are among the widely used industry classification schemes. NAICS is the first industrial classification system constructed to cover a large number of companies by grouping economic units that use similar processes in production (Ambler and Kristoff, 1998). Highlighting the "production" concept as the core of this classification system, Krishnan and Press (2003) noticed that NAICS provides a better classification for specific industries such as transportation and services. Additionally, as noted by Rai and Sambamurthy (2006), NAICS involves a larger number of service-related industries than the Standard Industrial Classification (SIC) system. Moreover, the authors argued that NAICS extensively covers services industries that have been transformed through innovation led by digital technologies. However, the superiority of one classification system is under debate. An opposing argument by Kile and Phillips (2009) underlines that the GICS classification system provides a better framework than SIC and NAICS for researchers whose target high-tech industries for analysis.

Considering the digital revolution transforming businesses and industries, industry classification systems designed to develop standard taxonomies inevitably receive criticism. According to Zhou et al. (2022), the reduced renewal periods of industrial systems and production technologies and transformation of businesses across industries are among the factors that complicate classification for businesses. Moreover, the emergence of new industries is another limitation (Xu et al., 2020) that requires updating existing classification schemes. Additionally, alternative industry classification methods were proposed by recent studies where businesses are clustered by analyzing patent records (Gkotsis et al., 2018) or financial statements (Kim et al., 2022).

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The North American Industry Classification System

According to the official NAICS document issued by The U.S. Census Bureau, sectors are identified with 2-digit codes, and each sector involves industries represented with 6-digit codes. A summary of NAICS sectors and subsectors is listed in Table 1. For a complete list of NAICS industries, the readers are encouraged to visit the NAICS Official Website:

https://www.naics.com/six-digit-naics/?code=54

Table 1. Sectors and subsectors in NAICS

Code	Definition and Subsectors
11	*Agriculture, Forestry, Fishing and Hunting*
	- Crop Production - Animal Production - Forestry & Logging - Fishing, Hunting & Trapping - Support Activities for Agriculture & Forestry
21	*Mining*
	- Oil & Gas Extraction - Mining (except Oil & Gas) - Support Activities for Mining
22	*Utilities*
	- Utilities
23	*Construction*
	- Construction of Buildings - Heavy & Civil Engineering Construction - Specialty Trade Contractors
31-33	*Manufacturing*
	- Food Manufacturing - Beverage & Tobacco Product Manufacturing - Textile Mills - Textile Product Mills - Apparel Manufacturing - Leather & Allied Product Manufacturing - Wood Product Manufacturing - Paper Manufacturing - Printing & Related Support Activities - Petroleum & Coal Products Manufacturing - Chemical Manufacturing - Plastics & Rubber Products Manufacturing - Nonmetallic Mineral Product Manufacturing - Primary Metal Manufacturing - Fabricated Metal Product Manufacturing - Machinery Manufacturing - Computer & Electronic Product Manufacturing
42	*Wholesale Trade*
	- Merchant Wholesalers - Durable Goods - Merchant Wholesalers - Nondurable Goods - Wholesale Electronic Markets, Agents & Brokers

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Table 1. Continued

Code	Definition and Subsectors
44-45	*Retail Trade*
	- Motor Vehicle & Parts Dealers - Furniture & Home Furnishings Stores - Electronics & Appliance Stores - Building Material, Garden Equipment & Supplies Dealers - Food & Beverage Stores - Health & Personal Care Stores - Gasoline Stations - Clothing & Clothing Accessories Stores - Sporting Goods, Hobby, Musical Instrument & Book Stores - General Merchandise Stores - Miscellaneous Store Retailers - Nonstore Retailers
48-49	*Transportation and Warehousing*
	- Air Transportation - Rail Transportation - Water Transportation - Truck Transportation - Transit & Ground Passenger Transportation - Pipeline Transportation - Scenic & Sightseeing Transportation - Support Activities for Transportation - Postal Service - Couriers & Messengers - Warehousing & Storage
51	*Information*
	- Publishing Industries (except Internet) - Motion Picture & Sound Recording Industries - Broadcasting (except Internet) - Telecommunications - Data Processing, Hosting & Related Services - Other Information Services
52	*Finance and Insurance*
	- Monetary Authorities-Central Bank - Credit Intermediation & Related Activities - Securities, Commodity Contracts & Other Financial Investments & Related Activities - Insurance Carriers & Related Activities - Funds, Trusts & Other Financial Vehicles
53	*Real Estate and Rental and Leasing*
	- Real Estate - Rental and Leasing Services - Lessors of Nonfinancial Intangible Assets (except Copyrighted Works)
54	*Professional, Scientific, and Technical Services*
	- Professional, Scientific & Technical Services
55	*Management of Companies and Enterprises*
	- Management of Companies & Enterprises
56	*Administrative and Support and Waste Management and Remediation Services*
	- Administrative & Support Services - Waste Management & Remediation Services

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Table 1. Continued

Code	Definition and Subsectors
61	*Educational Services*
	- Educational Services
62	*Health Care and Social Assistance*
	- Ambulatory Health Care Services - Hospitals - Nursing & Residential Care Facilities - Social Assistance
71	*Arts, Entertainment, and Recreation*
	- Performing Arts, Spectator Sports & Related Industries - Museums, Historical Sites, Similar Institutions - Amusement, Gambling, Recreation Industries
72	*Accommodation and Food Services*
	- Accommodation - Food Services & Drinking Places
81	*Other Services (except Public Administration)*
	- Repair & Maintenance - Personal & Laundry Services - Religious, Grantmaking, Civic, Professional & Similar Organizations - Private Households
92	*Public Administration*
	- Executive, Legislative & Other General Government Support - Justice, Public Order & Safety Activities - Administration of Human Resource Programs - Administration of Environmental Quality Programs - Administration of Housing Programs, Urban Planning & Community Development - Administration of Economic Programs - Space Research & Technology - National Security & International Affairs

The NAICS and other classification systems benefit researchers from various domains in several ways. Firstly, such systems clarify the scope for investigation and benchmarking in various disciplines, particularly for finance and economics (Bhojraj, Lee, and Oler, 2003). Secondly, such systems provide a framework that guides academic research when comparing economic entities. For instance, a study to explore the specialization of high technology centers by Cortright and Mayer (2001) used the NAICS classification system when determining high-tech industry codes. The authors examined patent data for classification, compared districts in the US, and finally reported the specialization of locations. Similarly, Hecker (2005) referenced the NAICS classification when presenting employment figures and projections in high-tech businesses.

Another advantage of the NAICS is its recognition in online academic databases. For example, an announcement by EBSCO (EBSCO Connect, 2018) has declared that articles are listed with relevant NAICS industries adjacent to their subject list. In this regard, providing the publication-industry linkages is a distinctive feature of the EBSCO database, particularly for researchers to examine those relations among publication meta-data.

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METHODOLOGY

Scientometric studies correspond to the quantitative analysis of scientific literature (Rawat and Sood, 2021) towards measuring and analyzing publications assuming that those publications represent scientific activities (Heilig and Voß, 2014). Our chapter explores the prominent sectors in IS research by following a scientometric approach by examining industries involved in keywords. The primary data source for our approach consists of the industry codes located in publication meta-data provided in the EBSCO database. Our research strategy involves the selection of IS journals, meta-data collection from the EBSCO database, and reviewing the frequency of IS publications linked with NAICS industries and sectors.

The keyword data in publications typically contains relevant topics, methods, and concepts. HaCohen-Kerner (2003) defined keywords as the most common type of summaries in academic papers. Keyword analysis is a useful method for identifying trending topics in bibliometric studies (Pesta et al., 2018). In particular, the frequency of keywords is often helpful in discovering hot spots in disciplines (Wang and Chai, 2018). Accordingly, our study compares the frequency of subjects (keywords) corresponding to NAICS industries and groups those industries into sectors.

In scientometric studies, index keywords are used as well as author keywords that are assigned by professional indexers (Heilig and Voß, 2014). EBSCO standardizes author-provided keywords with a reference subject index, namely the Comprehensive Subject Index (EBSCO Website, 2018). Additionally, EBSCO lists relevant NAICS industries along with publications. Accordingly, our study refers to those index keywords to determine the relevance of publications to industries and sectors.

Journal Selection

Our chapter refers to prior studies that presented a collection of top journals in the IS discipline. The study by Orlikowski and Baroudi (1991) examined 155 IS research articles published between 1983 and 1988 in major IS journals. The authors presented a selected list of IS journals, which include Communications of ACM, Proceedings of the International Conference on Information Systems, Management Science, and MIS Quarterly. A more extensive list of 50 IS journals was presented by Mylonopoulos and Theoharakis (2001), which was often used as a reference in subsequent studies.

The review by Schwartz and Russo (2004) that compared online academic indexes concerning their inclusion of top IS journals reported that "EBSCO Business Source Premier" has the highest coverage. According to the results presented, EBSCO comes forward with a coverage rate of over 40%, whereas ABI/INFORM and ACM covered approximately 28% and 15%, respectively. Willcocks et al. (2008) also presented several lists of IS journals categorized according to their focus. We note that the lists proposed in Mylonopoulos and Theoharakis (2001) and Willcocks et al. (2008) were mainly identical.

Such rankings have also been criticized in different ways. Singh, Haddad, and Chow (2007) argued that a journal list in management studies involves errors in classification and advocated for evaluating articles by their quality rather than their outlet. Nevertheless, the criticism targeted the methodology rather than the top journals included in the list.

Since our study depends on NAICS industries attached to publications, our journal list was restricted by the availability of industry codes in data collection. To our knowledge, EBSCO is the only research database that links publications with NAICS industries. Accordingly, 20 journals from the top-50 list of Mylonopoulos and Theoharakis (2001) were included in our study.

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Table 2. List of journals selected for data collection

ISSN	Journal	ISSN	Journal
0001-4273	Academy of Management Journal	1047-7047	Information Systems Research
0363-7425	Academy of Management Review	1086-4415	International Journal of Electronic Commerce
0360-0300	ACM Computing Surveys	0888-7985	Journal of Information Systems
0362-5915	ACM Transactions on Database Systems	0742-1222	Journal of Management Information Systems
0001-8392	Administrative Science Quarterly	1536-9323	Journal of The Association for Information Systems
0001-0782	Communications of the ACM	0025-1909	Management Science
0011-7315	Decision Sciences	0276-7783	MIS Quarterly
0737-0024	Human-Computer Interaction	1532-9194	MIT Sloan Management Review
0197-2243	The Information Society	1047-7039	Organization Science
1350-1917	Information Systems Journal	0097-5397	SIAM Journal on Computing

Data Collection

Data collection was held using a prototype software developed by the author (Kabasakal, 2019) that aimed to explore emerging topics and concepts in IS publications. The software was developed with C# as a desktop application for Windows using Microsoft Visual Studio. The software uses Chrome-Driver of the Selenium automation tool to locate, browse, and parse the meta-data. The meta-data for a publication consists of the title, volume, issue, DOI, and index keywords provided by EBSCO. Sectors, industries, journals, articles, keywords, and other publication meta-data were stored in a Microsoft SQL Server database. Our analysis primarily relies on the annual frequencies of index keywords that precisely correspond to a NAICS industry.

Data Preprocessing

The data collected for the study consists of 33200 entries involving publications and other types of content such as editorial notes, announcements, and calls for papers. Since our chapter primarily aims to analyze IS publications, 1981 entries of other content types were marked for exclusion.

Final Dataset

The dataset analyzed consists of index keywords for 31219 publications published in 20 IS journals between 1996 and 2020. Annual publication counts for each journal are listed in Table 3.

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Table 3 (a). Annual publication counts in research dataset – grouped by journals

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Academy of Management Journal	64	67	44	45	76	76	78	54	61	81	75	92
Academy of Management Review	64	44	55	71	71	51	45	62	65	74	83	83
ACM Computing Surveys	115	13	14	13	14	12	14	13	12	11	13	12
ACM transactions on database systems	3	13	12	13	12	12	11	15	21	31	38	27
Administrative Science Quarterly	58	54	63	66	53	64	77	71	56	45	46	37
Communications of the ACM	406	474	279	295	268	332	325	400	327	376	360	289
Decision Sciences	61	39	44	47	36	28	27	28	31	23	31	28
Human-Computer Interaction	14	13	13	11	11	20	9	14	20	12	11	12
Information Systems Journal			16	18	16	16	17	18	18	18	15	20
Information Systems Research	27	21	22	22	24	23	27	18	20	22	24	24
International Journal of Electronic Commerce					8	24	28	23	31	24	23	21
Journal of Information Systems	7	6	8	9	32	7	35	20	23	20	21	16
Journal of Management Information Systems	37	39	33	39	37	37	40	37	38	45	44	42
Journal Of The Association For Information Systems								16	18	13	34	33
Management science	125	125	145	119	115	117	108	112	152	140	155	136
MIS Quarterly	41	30	41	53	49	33	28	26	30	33	46	36
MIT Sloan Management Review						77	75	76	78	68	69	77
Organization Science	44	41	60	48	45	47	45	47	51	45	49	60
SIAM Journal on Computing		83	144	103	118	84	55	75	71	73	105	84
The Information Society		29	31	31	34	32	45	41	62	48	44	55
Total	**1066**	**1091**	**1024**	**1003**	**1019**	**1092**	**1089**	**1166**	**1185**	**1202**	**1286**	**1184**

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Table 3 (b). Annual publication counts in research dataset – grouped by journals

2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
64	63	70	61	67	80	78	85	95	97	93	76	75	1817
83	44	30	41	37	47	36	47	45	46	47	62	54	1387
19	20	15	31	38	68	28	68	69	107	29	93	135	976
31	25	29	27	30	28	34	21	18	11	11	12	16	501
43	54	47	39	38	30	47	38	37	37	42	42	44	1228
364	454	418	385	334	310	304	343	354	329	340	294	319	8679
32	33	36	34	40	41	40	41	40	38	35	39	48	920
10	11	11	10	13	16	17	18	14	18	22	14	17	351
29	23	22	21	22	26	21	25	26	30	51	51	38	557
26	30	55	48	74	61	49	47	51	51	52	76	73	967
23	21	22	23	21	20	17	27	10	21	20	21	20	448
25	14	11	17	24	28	30	26	27	22	18	41	34	521
44	39	43	42	43	43	46	51	43	42	42	43	52	1041
34	36	34	31	38	33	36	31	29	54	46	61	61	638
151	143	143	138	130	168	165	170	179	264	326	304	301	4131
38	47	42	54	70	66	59	48	51	64	62	60	64	1171
74	74	72	57	58	61	48	70	91	85	68	108	22	1408
53	62	71	102	101	95	92	99	84	61	65	66	74	1607
85	103	77	61	71	93	74	57	69	62	73	48	65	1933
43	38	42	46	45	39	40	42	41	29	26	27	28	938
1271	**1334**	**1290**	**1268**	**1294**	**1353**	**1261**	**1354**	**1373**	**1468**	**1468**	**1538**	**1540**	**31219**

FINDINGS AND DISCUSSION

Our findings depend on comparisons regarding the frequency of publications with a NAICS-keyword from 1996 to 2020. The results compare the frequency of publications relevant to sectors and industries and present the overall industry orientation of the discipline. Moreover, we describe the industry orientation of the Information Systems journals by presenting the top sectors that match the publications they published.

Before discussing the sectoral orientation of IS research, we first note the increasing annual counts in IS publications over 25 years. Although this partially relates to EBSCO's expanding coverage in 1996-2001, the increase since the 2000s signifies a growing body of knowledge in IS research.

Limitations

This study explores the industry orientation of IS research by examining subject lists in publication metadata that were only published in a set of IS journals. A major consideration is the lack of conference proceedings, books, and chapters authored by IS scholars that could provide significant insights about which sectors and industries are more interesting for the IS community. Moreover, focusing on patent

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applications and licenses or other indicators for industry-university collaboration would be alternative research ideas to examine which sectors/industries are more revisited in a science field.

Our dataset is limited to meta-data of articles published in IS journals highly ranked in literature reviews. However, such rankings might change over time and might be controversial. Moreover, data collection was possible for 20 journals accessible on EBSCO by the author via institutional membership.

Another limitation of our study is the distinction between author-provided keywords and the subject list assigned by the online publisher. This practice in online databases reduces complexity and helps to standardize keywords. On the other hand, this practice often leads to the indexer effect (He, 1999), which is a problem arising from the subjectivity in keyword selection for publications. As noted by HaCohen-Kerner (2003), this problem might come up as a result of the selection of keywords that summarize full texts. Similar concerns might arise for the lists of subjects in publications indexed by EBSCO. EBSCO has a subject index that follows a systematic topology aligned with the US Library of Congress (EBSCO Website, 2018). Accordingly, we assumed that the NAICS codes assigned to publications infer meaningful links between publications and those industries.

Findings

Before presenting the findings, we underline that total frequency of IS publications with a NAICS industry in their subjects was assumed to signify the popularity of that industry and corresponding sector. By this means, Table 4 presents the most popular NAICS sectors and industries for IS research. According to our results, "Computer systems design and related services" was the most popular NAICS industry that appeared in the index keywords of 2492 (7.98%) of 31219 publications. Subsequently, "Internet Publishing and Broadcasting and Web Search Portals" and "Computer, computer peripheral and pre-packaged software merchant wholesalers" were the most prominent NAICS industries.

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Table 4. Top NAICS industries by sectors according to the frequency of relevant publications

Sector Code	Description	Industry Code	Description	Publications
54	Professional, Scientific & Technical Services	541514	Computer systems design and related services (except video game design and development)	2492 (7.98%)
		541712	Research and Development in the Physical, Engineering, and Life Sciences (except Biotechnology)	1852 (5.93%)
		541710	Research and development in the physical, engineering and life sciences	1627 (5.21%)
		541511	Custom Computer Programming Services	1563 (5.01%)
51	Information	519130	Internet Publishing and Broadcasting and Web Search Portals	2450 (7.85%)
		511211	Software publishers (except video game publishers)	1958 (6.27%)
		519190	All Other Information Services	1629 (5.22%)
44 - 45	Retail Trade	443120	Computer and software stores	1965 (6.29%)
		454110	Electronic shopping and mail-order houses	1302 (4.17%)
		454111	Electronic Shopping	1238 (3.97%)
42	Wholesale Trade	417310	Computer, computer peripheral and pre-packaged software merchant wholesalers	1967 (6.30%)
		423430	Computer and Computer Peripheral Equipment and Software Merchant Wholesalers	1863 (5.97%)
		417320	Electronic components, navigational and communications equipment and supplies merchant wholesalers	249 (0.80%)
31-33	Manufacturing	334110	Computer and peripheral equipment manufacturing	1161 (3.72%)
		334111	Electronic Computer Manufacturing	1040 (3.33%)
		334220	Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing	296 (0.95%)
52	Finance & Insurance	523930	Investment Advice	412 (1.32%)
		523999	Miscellaneous Financial Investment Activities	378 (1.21%)
		522291	Consumer Lending	344 (1.10%)
92	Public Administration	923130	Administration of Human Resource Programs (except Education, Public Health, and Veterans' Affairs Programs)	549 (1.76%)
		923110	Administration of Education Programs	236 (0.76%)
		922190	Other Justice, Public Order, and Safety Activities	176 (0.56%)
56	Adm., Support, Waste Mgmt. & Remediation Services	561990	All Other Support Services	386 (1.24%)
		561920	Convention and Trade Show Organizers	191 (0.61%)
		561621	Security Systems Services (except Locksmiths)	173 (0.55%)
62	Health Care & Social Assistance	624190	Other Individual and Family Services	570 (1.83%)
		624310	Vocational Rehabilitation Services	193 (0.62%)
		624230	Emergency and Other Relief Services	107 (0.34%)
81	Other Services (except Public Administration)	811213	Communication Equipment Repair and Maintenance	239 (0.77%)
		813990	Other Similar Organizations (except Business, Professional, Labor, and Political Organizations)	167 (0.53%)
		813920	Professional Organizations	83 (0.27%)

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Table 4. Continued

Sector Code	Description	Industry Code	Description	Publications
61	Educational Services	611310	Colleges, Universities, and Professional Schools	320 (1.03%)
		611430	Professional and Management Development Training	230 (0.74%)
		611699	All Other Miscellaneous Schools and Instruction	216 (0.69%)
23	Construction	236220	Commercial and Institutional Building Construction	164 (0.53%)
		238210	Electrical Contractors and Other Wiring Installation Contractors	114 (0.37%)
		238299	All other building equipment contractors	41 (0.13%)
53	Real Estate, Rental & Leasing	533110	Lessors of Nonfinancial Intangible Assets (exc. Copyrighted Works)	109 (0.35%)
		531210	Offices of Real Estate Agents and Brokers	53 (0.17%)
		532299	All Other Consumer Goods Rental	53 (0.17%)
71	Arts, Entertainment, and Recreation	711510	Independent Artists, Writers, and Performers	109 (0.35%)
		711513	Independent writers and authors	53 (0.17%)
		713290	Other Gambling Industries	44 (0.14%)
48	Transportation & Warehousing	481110	Scheduled air transportation	61 (0.20%)
		481111	Scheduled Passenger Air Transportation	58 (0.19%)
		488999	All Other Support Activities for Transportation	51 (0.16%)
72	Accommodation & Food Services	722511	Full-Service Restaurants	32 (0.10%)
		721110	Hotels (except Casino Hotels) and Motels	30 (0.10%)
		721120	Casino Hotels	17 (0.05%)
55	Mgmt. of Companies & Enterprises	551114	Corporate, Subsidiary, and Regional Managing Offices	56 (0.18%)
		551112	Offices of Other Holding Companies	20 (0.06%)
22	Utilities	221113	Nuclear Electric Power Generation	27 (0.09%)
		221114	Solar Electric Power Generation	26 (0.08%)
		221115	Wind Electric Power Generation	26 (0.08%)
11	Ag. Forestry, Fishing & Hunting	111339	Other Noncitrus Fruit Farming	5 (0.02%)
		112990	All Other Animal Production	5 (0.02%)
		115113	Crop Harvesting, Primarily by Machine	5 (0.02%)
21	Mining	211111	Crude Petroleum and Natural Gas Extraction	24 (0.08%)
		213112	Support Activities for Oil and Gas Operations	19 (0.06%)
		211113	Conventional oil and gas extraction	18 (0.06%)

In addition to the overall industry-level rankings, we present the annual frequency of articles related to NAICS sectors in Table 5. We note that articles relevant to multiple sectors are accounted for in each sector.

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Table 5 (a). Prominent NAICS sectors in IS publications

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Prof. Scientific & Technical Services	386	289	281	292	256	324	311	324	370	363	419	407
Information	346	307	277	280	311	311	352	385	329	357	395	328
Retail Trade	241	193	125	126	160	197	209	220	189	218	220	165
Wholesale Trade	251	196	108	105	140	146	149	124	143	182	177	143
Manufacturing	226	181	107	127	129	122	133	117	123	150	129	131
Finance & Insurance	46	50	55	64	74	82	89	72	72	77	85	66
Public Adm.	77	64	63	84	64	70	77	85	86	96	70	99
Adm. Support Waste Mgmt. & Remediation Services	67	44	50	44	32	66	40	26	53	51	55	47
Health Care & Social Assistance	17	21	21	22	29	27	33	29	31	49	31	50
Other Serv. (except Public Adm.)	50	27	38	31	52	53	38	45	32	53	38	20
Educational Services	36	32	29	29	22	33	47	22	38	46	45	38
Construction	23	15	15	15	15	18	9	15	21	10	24	19
Real Estate Rental & Leasing	9	7	9	5	11	13	16	14	5	11	17	16
Arts, Entertainment & Recreation	12	9	15	5	18	5	13	5	8	13	12	15
Transportation & Warehousing	11	12	13	7	12	18	9	9	20	9	16	8
Accommodation & Food Services	2	4	3	5			3	1	8	2	4	1
Mgmt. of Companies & Enterprises	2	3	4	4	5	2	4	2	4	1	2	4
Utilities	3	3	1	4	1	6		1		3	2	1
Agriculture, Forestry, Fishing & Hunting		2	3	2	2	2	1		1	2		
Mining	2	2		2	1	4		1	1	2	1	2

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Table 5 (b). Prominent NAICS sectors in IS publications

2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
389	471	440	358	353	353	324	309	283	265	254	235	197	8253 (26.4%)
334	364	379	325	330	269	277	230	231	212	213	199	166	7507 (24.0%)
210	199	156	149	165	129	123	123	102	124	127	96	74	4040 (12.9%)
189	169	127	120	131	118	105	106	95	99	91	70	62	3346 (10.7%)
179	148	131	133	131	110	98	93	79	82	73	95	80	3107 (10.0%)
87	80	62	76	76	69	83	65	83	92	109	99	78	1891 (6.1%)
72	92	75	55	60	55	52	46	72	59	62	87	39	1761 (5.6%)
77	68	50	41	46	43	40	34	40	31	40	38	39	1162 (3.7%)
53	51	52	62	62	56	48	62	41	49	58	56	55	1065 (3.4%)
42	25	48	53	38	39	26	31	38	21	22	37	29	926 (3.0%)
57	52	52	38	30	24	29	21	29	34	25	29	16	853 (2.7%)
23	12	18	19	13	18	14	9	14	8	11	20	22	400 (1.3%)
14	22	10	19	23	12	5	13	8	15	10	12	16	312 (1.0%)
7	7	12	19	13	8	14	11	11	9	20	9	16	286 (0.9%)
9	9	9	6	7	10	4	9	9	6	8	10	16	256 (0.8%)
3	4		2	2	4	7	3	2	6	6	6	2	80 (0.3%)
3	3	2	3	3	3	7	2	2	1	2	3	2	73 (0.2%)
2	6	3	3	6	2	2	2	3	3	1	2	4	64 (0.2%)
2	2	1	1	1	1	5	1	1		3	9	1	43 (0.1%)
1	3	4			2	2	3	2		1	3		39 (0.1%)

According to the results in Table 5, “Professional, Scientific & Technical Services” was the most prominent NAICS sector. Within our research dataset consisting of 31219 publications, 8253 (26.4%) had at least one industry located under this sector according to NAICS taxonomy. “Information”, “Retail Trade”, “Wholesale Trade” and “Manufacturing” were also found in 24.0% and 12.9%, 10.7% and 10.0% of the publications, respectively. On the other hand, we note that the sectors such as mining, agriculture, forestry, utilities, accommodation and food services, which had much smaller ratios were less popular in IS research.

Table 6 below compares the overall sector-orientation of IS journals. For each journal, we calculate the overall sector-orientation by the ratio of publications that have at least one NAICS keyword. The results demonstrate that “International Journal of Electronic Commerce”, “Communications of the ACM”, “Journal of Management Information Systems” and “Information Systems Research” were the most sector-oriented outlets where 87.5%, 76.8%, 75% and 71.9% of publications were found relevant to a NAICS sector.

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Table 6 (a). Annual publication counts with at least one NAICS industry among index keywords

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Academy of Management Journal	38	34	33	26	50	45	50	31	41	53	34	61
Academy of Management Review	12	10	15	27	27	18	12	18	13	28	30	28
ACM Computing Surveys	100	12	9	9	9	9	12	12	8	11	10	10
ACM Transactions on Database Systems	3	9	11	6	8	9	8	12	18	27	30	23
Administrative Science Quarterly	19	15	10	20	16	20	17	16	16	16	16	9
Communications of the ACM	361	339	259	258	225	291	277	332	267	317	303	247
Decision Sciences	43	24	28	36	21	22	17	16	22	21	15	22
Human-Computer Interaction	3	2	2	4	2	12	7	4	10	11	6	6
Information Systems Journal			7	11	8	12	12	11	14	12	15	18
Information Systems Research	15	19	16	16	20	16	24	14	17	15	22	21
International Journal of Electronic Commerce					7	24	25	23	31	21	21	21
Journal of Information Systems	7	3	7	9	28	7	34	17	16	17	12	10
Journal of Management Information Systems	33	28	23	35	29	33	30	32	24	38	41	35
Journal of the Association for Information Systems								12	15	9	19	28
Management science	84	103	112	98	80	91	85	81	123	108	115	94
MIS Quarterly	22	23	19	28	28	21	23	17	18	24	39	22
MIT Sloan Management Review						54	46	43	41	40	43	50
Organization Science	21	23	29	17	19	28	20	29	24	26	29	28
SIAM Journal on Computing		2	11	17	32	14	10	23	33	32	31	30
The Information Society		12	14	19	23	20	23	20	33	29	27	32
Total	**761**	**658**	**605**	**636**	**632**	**746**	**732**	**763**	**784**	**855**	**858**	**795**

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Table 6 (b). Annual publication counts with at least one NAICS industry among index keywords

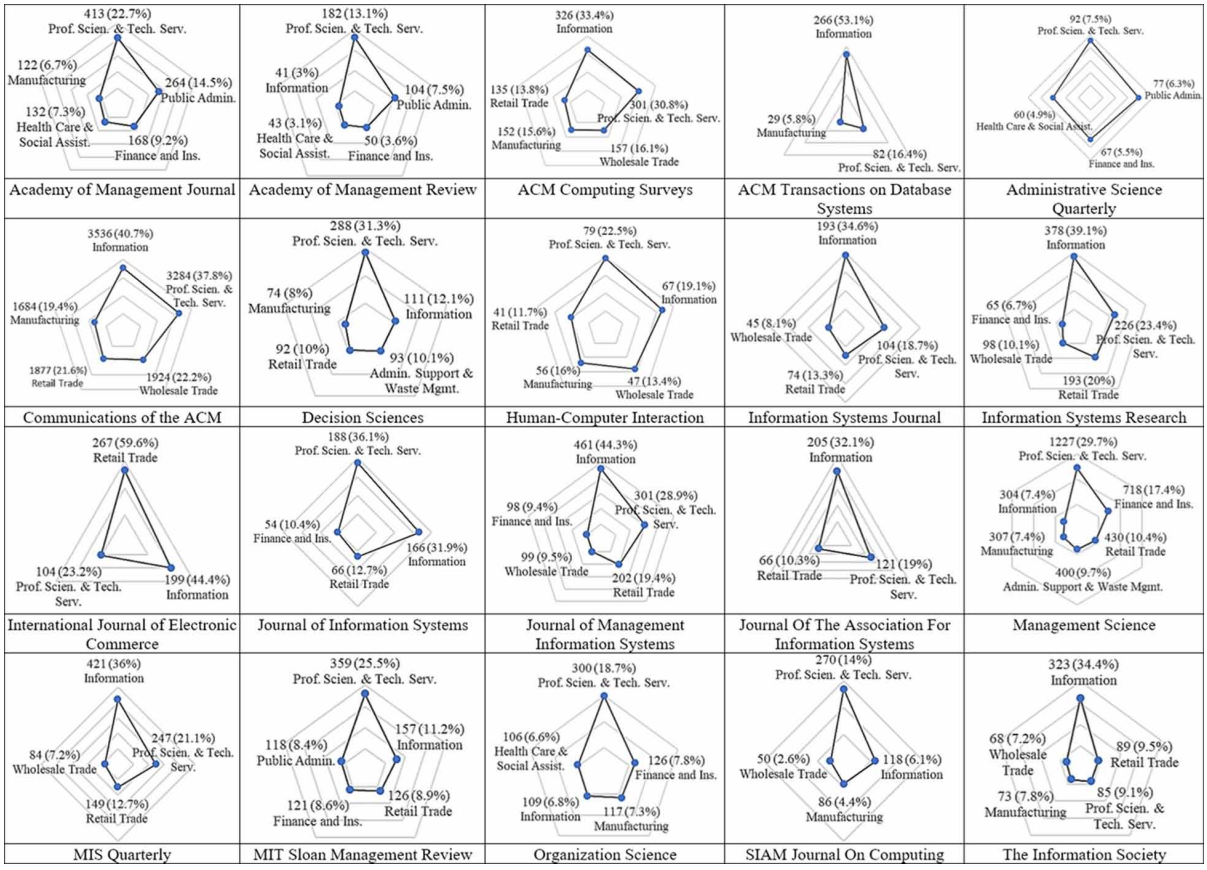
2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	NAICS Articles / Total		
35	40	34	23	31	42	31	43	41	27	32	29		904	1817	49.8%
24	8	9	11	11	11	8	8	14	7	10	6		365	1387	26.3%
14	15	14	22	31	46	19	41	36	61	15	46		571	976	58.5%
20	11	24	12	18	21	19	13	9	6	6	7		330	501	65.9%
15	18	13	12	13	10	16	16	11	10	17	15	11	367	1228	29.9%
315	378	333	281	238	222	227	228	217	186	209	171	185	6666	8679	76.8%
24	24	20	17	24	20	22	28	21	22	20	22	22	573	920	62.3%
10	10	7	4	6	8	11	11	8	4	9	6	7	170	351	48.4%
18	17	15	15	16	17	12	8	16	18	21	27	17	337	557	60.5%
21	23	45	33	57	51	35	30	34	28	31	42	50	695	967	71.9%
18	18	20	18	18	18	14	23	9	21	13	16	13	392	448	87.5%
16	9	4	13	13	13	18	10	22	16	6	20	18	345	521	66.2%
38	34	35	33	35	26	33	26	23	31	29	28	29	781	1041	75.0%
31	22	27	18	23	11	23	19	15	28	21	23	25	369	638	57.8%
99	103	88	87	75	102	97	92	101	123	168	154	146	2609	4131	63.2%
28	31	29	38	48	36	41	21	29	29	27	32	20	693	1171	59.2%
54	46	27	34	32	32	20	31	49	36	26	30	4	738	1408	52.4%
21	25	40	52	50	45	49	49	25	26	32	29	28	764	1607	47.5%
22	47	25	16	15	16	14	10	7	7	14	10	14	452	1933	23.4%
26	20	30	26	26	11	22	12	19	9	12	18	21	504	938	53.7%
849	**899**	**839**	**765**	**780**	**758**	**731**	**719**	**706**	**695**	**718**	**731**	**610**	**18625**	**31219**	**59.7%**

Sectoral Orientation by Journal

Each radar chart in Figure 1 presents top sectors for journals, determined by considering the frequency of sector-related publications they published. As the first chart suggests, 413 of 1817 (22.7%) articles published in Academy of Management Journal were relevant to an industry within the sector "Professional, Scientific & Technical Services", while 14.5% and 9.2% were relevant to "Public Administration", and "Finance & Insurance". Accordingly, we underline a high research interest towards these sectors in the Academy of Management Journal. A highly intensive research interest (59.6%) towards "Retail Trade" is noticeable in the International Journal of Electronic Commerce. Similarly, ACM Transactions on Database Systems was found highly related (53.1%) to the sector 'Information'.

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Figure 1. Top sectors for journals determined according to their ratio of NAICS-related publications

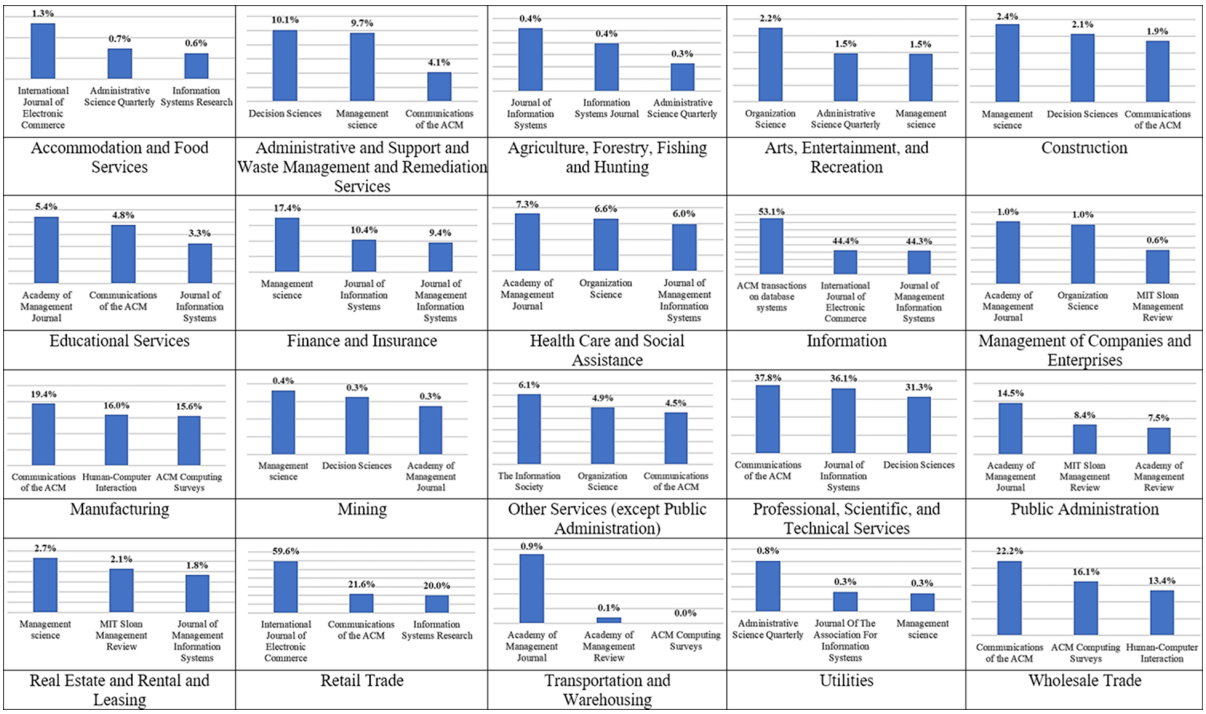


Top Journals by NAICS Sectors

This section presents the top journals for each NAICS sector. As Table 3 demonstrates, the variance in total articles published is high. For instance, the count of articles published in Communications of the ACM was ~24.7 times higher than those published International Journal of Electronic Commerce. Therefore, we determine which journal has more substantial research interest in a sector by comparing journals with their ratio of sector-oriented articles.

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Figure 2. Journals compared according to their ratio of relevant publications by sector



The findings signify that IS journals are primarily oriented towards NAICS sectors: 'Information', 'Professional, Scientific, and Technical Services', 'Retail Trade', 'Wholesale Trade', and 'Manufacturing'. On the other hand, low ratios of publications were noticed for 'Accommodation & Food Services', 'Agriculture, Forestry, Fishing and Hunting', 'Management of Companies and Enterprises', 'Mining', 'Transporting & Warehousing' and 'Utilities'. Considering those sectors listed, ratios below 1.3% were found in all journals.

An unsurprising but remarkable finding is that 59.6% of articles published in 'International Journal of Electronic Commerce' relate to 'Retail Trade'. In more detail, 267 of 448 (59.6%) publications from this journal were assumed to be related to this sector. To perform a cross-check, the term "Retail Trade" was searched using the tool on the journal website, which resulted in 188 publications by June 9, 2022. In addition to those matches, we speculate that at least 79 publications might have been labeled by EBSCO indexers considering their scope.

The bar chart for 'Information' demonstrates that more than 50% of articles published in 'ACM Transactions on Database Systems' were relevant to this sector. Moreover, the ratios of 44.4% and 44.3% for journals 'International Journal of Electronic Commerce' and 'Journal of Management Information Systems' signify that those journals often published papers related to this sector.

The most relevant journals for the sector 'Professional, Scientific, and Technical Services' were 'Communications of the ACM', 'Journal of Information Systems', and 'Decision Sciences'. These journals have published considerably high rates of (37.8%-31.3%) relevant articles.

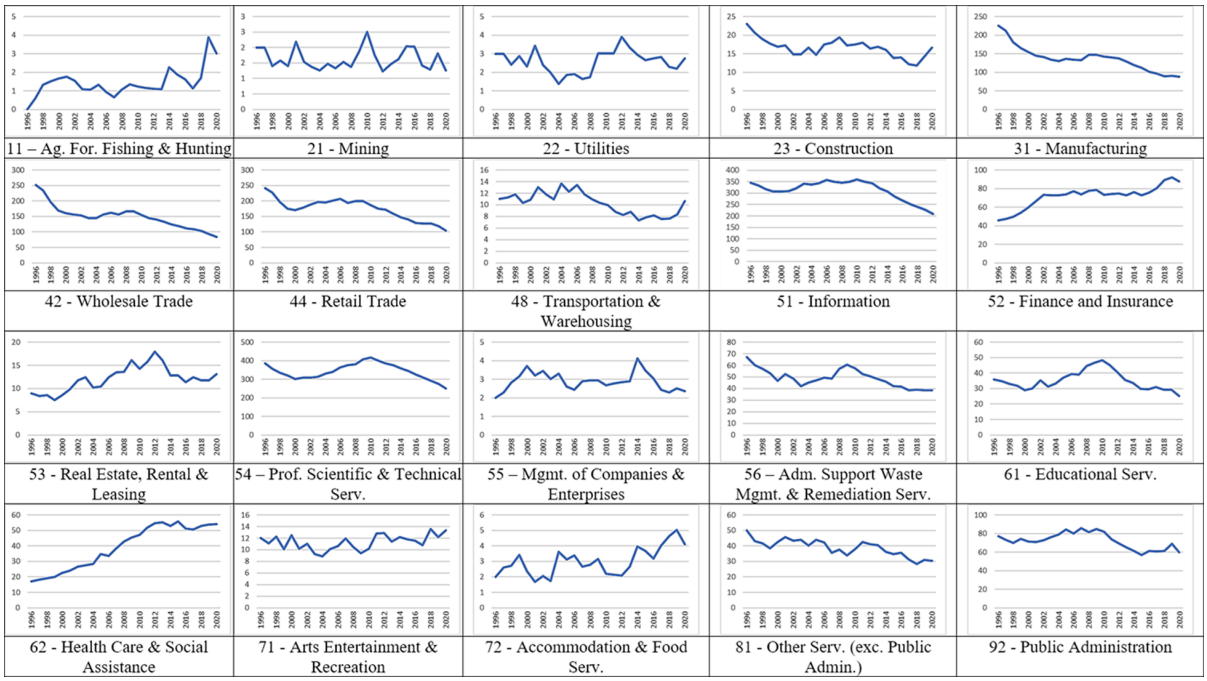
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Trends of Sectoral Orientation in IS Research

The results presented above have summarized the sectoral orientation in IS journals from different angles by referencing and comparing up-to-date numbers. However, focal problems, popular theories, areas of interest, and even research paradigms change over time in scientific research. Besides, the business environment has also changed over the last decades in many industries, which changed the competition as well as products and services.

To examine which sectors have gained or lost research interest from IS community, we present a yearly comparison of sectoral orientation in IS research in Figure 3. The figure involves a chart for each sector, where the frequency of relevant publications was depicted per year. To reduce the complexity, the line charts were smoothened.

Figure 3. Annual frequency of relevant IS publications for each sector



Smoothening data points in time series is a common practice that lets readers visualize the key features and underlying trends better (Wilke, 2019). Exponential smoothening was employed for this purpose due to its simplicity and inclusion of all past values with degrading degrees of importance. The method is often used in forecasting to generate results by assigning weights that exponentially decrease for older observations (Wu, 2019). A smoothing factor ($\propto$: $0<\propto<1$) is used in this adjustment that can be determined by trying multiple values and selecting the one that leads to the highest predictive performance. In our case, this was calculated as the average root mean squared error of time series calculated for NAICS sectors.

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Among the smoothing factors of 0.10, 0.15, 0.20, 0.25, and 0.30 applied; $\propto$=0.30 was taken that resulted in the lowest average root means squared error, therefore fits the data better.

Increasing and Decreasing Trends in Sector Orientation

The increase and decrease trends in sector orientation were identified through linear regression analysis with the least-squares approach. Subsequently, optimal slope and intercept values were found for each sector-trend line that best fits the frequency of the corresponding NAICS sector over 25 years. The sectors and corresponding slope values are listed in Table 7. Negative values in slope indicate declining trends, while positive ones indicate increasing trends for the line charts in Figure 3.

Table 7. Comparison of trend lines that represent sectors by slope

Sector		Slope	Sector		Slope
11	Agriculture, Forestry, Fishing & Hunting	0.0662	53	Real Estate, Rental & Leasing	0.1746
21	Mining	-0.0046	54	Prof. Scientific & Technical Serv.	-2.3215
22	Utilities	0.0215	55	Mgmt. of Companies & Enterprises	-0.0362
23	Construction	-0.0846	56	Admin., Support, Waste Mgmt. & Remediation Serv.	-0.5700
31-33	Manufacturing	-3.2992	61	Educational Services	-0.3246
42	Wholesale Trade	-3.9385	62	Health Care & Social Assistance	1.7123
48	Transportation & Warehousing	-0.1592	71	Arts, Entertainment & Recreation	0.1315
44-45	Retail Trade	-4.1685	72	Accommodation & Food Services	0.0831
51	Information	-5.3269	81	Other Serv. (except Public Admin.)	-0.5469
52	Finance & Insurance	1.2292	92	Public Admin.	-0.8200

As the results demonstrate, the slope was positive in 7 sectors, while the remaining 13 had a negative slope. To better distinguish noticeable trends, the sectors were clustered according to their slopes. For this purpose, the k-means clustering algorithm was employed to identify groups of sectors with the highest similarity based on their slopes. For clustering 20 sectors with this algorithm (n=20), cluster count was determined as k=3 with the rule-of-thumb formula (Kodinariya & Makwana, 2013) below:

$$k \approx \sqrt{n/2}$$

Table 8 presents the clustering results, that identify three main groups of sectors.

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Table 8. Notable trends in sectors based on frequencies of relevant publications

Cluster Description	Mean (Slope)	Members (NAICS Sectors)
Cluster 1 Sectors Gaining Attention (2 Sectors)	1.47075	52 Finance and Insurance 62 Health Care and Social Assistance
Cluster 2 Sectors Losing Attention (7 Sectors)	-2.91736	31-33 Manufacturing 42 Wholesale Trade 44-45 Retail Trade 51 Information 54 Prof. Scientific, and Technical Services 81 Other Services (except Public Admin.) 92 Public Administration
Cluster 3 Stable (11 Sectors)	-0.06385	11 Agriculture, Forestry, Fishing & Hunting 21 Mining 22 Utilities 23 Construction 48 Transportation & Warehousing 53 Real Estate, Rental & Leasing 55 Mgmt. of Companies & Enterprises 56 Admin., Support, Waste Mgmt. & Remediation Services 61 Educational Services 71 Arts, Entertainment and Recreation 72 Accommodation and Food Services

Cluster 1 involves the sectors 52 and 62 and has the highest slope of ~1.47. Accordingly, research interest towards sectors 'Health Care and Social Assistance' and 'Finance and Insurance' has been significantly increasing. This finding highlights the increasing attention towards healthcare and related industries from Information Systems research before COVID-19 pandemic.

Cluster 2 represents the group of sectors that receive declining research interest from 1996 to 2020. This cluster includes the sectors: 'Other Services (except Public Administration)', 'Public Administration', 'Manufacturing', 'Wholesale Trade', 'Retail Trade', 'Information', and 'Professional Scientific and Technical Services'.

Among the results presented, the decline trend in 'Manufacturing' requires attention considering the recent progress in manufacturing. The rapid progress achieved with digitalization in manufacturing and relevant industries has been often cited as Industry 4.0 that implies a new revolution in manufacturing. Industry 4.0 concept has been one of the hotspots for scholars in business administration and engineering over the last decade that signify notable changes in job qualifications and skill requirements (Kaymaz et al., 2019). According to Google Trends, the term has received intensive interest from online users since 2014. Surprisingly, our results reveal the declining frequency of manufacturing industries within the subject list of Information Systems publications.

Another important finding is that, among the seven sectors found in Cluster 2, six were listed in Table 5 as the top sectors in IS research. Accordingly, those sectors that had attracted the highest degree of research interest might be losing their popularity among the IS community.

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Sector and Industry Links in Article-Level

Our findings also include an annual comparison of NAICS subjects linked in articles. Table 9 lists the article counts, the number of articles linked to a NAICS industry, and the average count of industries and sectors.

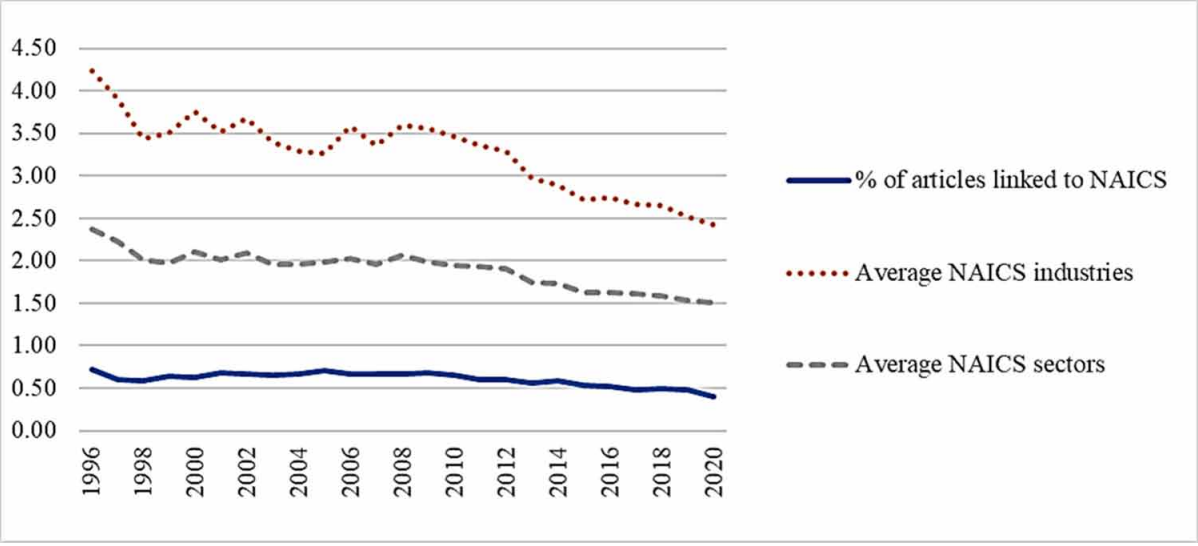
Table 9. Annual comparison of average industries, sectors and keywords in articles

Year	Articles	Articles with a NAICS Industry	Average			NAICS / Subjects (%)
			Industries	Sectors	Keywords	
1996	1066	761 (71.39%)	4.2286	2.3745	11.8410	35.71%
1997	1091	658 (60.31%)	3.9027	2.2204	11.3663	34.34%
1998	1024	605 (59.08%)	3.4314	2.0116	11.3488	30.24%
1999	1003	636 (63.41%)	3.4969	1.9701	11.5991	30.15%
2000	1019	632 (62.02%)	3.7595	2.1108	11.3750	33.05%
2001	1092	746 (68.32%)	3.5094	2.0094	11.0898	31.65%
2002	1089	732 (67.22%)	3.6735	2.0943	11.1434	32.97%
2003	1166	763 (65.44%)	3.3958	1.9620	10.2792	33.04%
2004	1185	784 (66.16%)	3.2844	1.9566	10.4834	31.33%
2005	1202	855 (71.13%)	3.2620	1.9825	10.7649	30.30%
2006	1286	858 (66.72%)	3.5793	2.0303	11.9580	29.93%
2007	1184	795 (67.15%)	3.3623	1.9623	11.2566	29.87%
2008	1271	849 (66.80%)	3.5972	2.0648	12.8151	28.07%
2009	1334	899 (67.39%)	3.5506	1.9878	12.7464	27.86%
2010	1290	839 (65.04%)	3.4636	1.9440	12.2872	28.19%
2011	1268	765 (60.33%)	3.3529	1.9373	12.2536	27.36%
2012	1294	780 (60.28%)	3.2936	1.9103	12.0833	27.26%
2013	1353	758 (56.02%)	2.9736	1.7480	10.5172	28.27%
2014	1261	731 (57.97%)	2.8892	1.7305	9.0711	31.85%
2015	1354	719 (53.10%)	2.7135	1.6314	8.6467	31.38%
2016	1373	706 (51.42%)	2.7465	1.6218	8.2635	33.24%
2017	1468	695 (47.34%)	2.6662	1.6058	8.1568	32.69%
2018	1468	718 (48.91%)	2.6504	1.5822	8.0390	32.97%
2019	1538	731 (47.53%)	2.5226	1.5253	7.9275	31.82%
2020	1540	610 (39.61%)	2.4262	1.4984	7.6148	31.86%
Overall	31219	18625 (59.66%)				

Notably, there is a decline in the ratio of articles with at least an industry in subject list. Besides, articles linked with sectors had an average of 4.23 industries from 2.37 sectors in 1996 that consistently dropped down to 2.43 and 1.50 in 2020. The decline in those numbers is visualized in the diagram below.

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Figure 4. Declining ratio NAICS industries/sectors in subjects



CONCLUSION

This study contributes to the prior literature with an attempt to explore the focal sectors and industries addressed in IS journals and quantify the overall industry orientation of the discipline from a broad perspective. Following a scientometric approach, the industry codes in meta-data were analyzed to measure the research interest towards sectors. Moreover, this chapter considers industry codes in index keywords as indicators that signify industry and sector-orientation of publications and journals.

A notable review (Chiasson and Davidson, 2005) focusing on the MIS Quarterly and Information Systems Research journals argued that the "industry receives little attention from IS research and theory". A more recent study by Bikard and Marx (2020) also argued that a small fraction of publications attracts interest from innovative companies. Our findings in Table 9 demonstrate that 59.66% of the IS publications had at least one NAICS industry within their index keywords. This ratio was higher (60%-70%) in 1996-2012 but dropped down to 40%'s over the last decade. Taking this rate as a criterion, we underline that the IS community has a considerably high degree of sector orientation. On the other hand, the decline in the last decade partially confirms the remarks by Bikard and Marx (2020).

"Professional, Scientific & Technical Services", "Information", "Retail Trade", "Wholesale Trade", and "Manufacturing" were found to be the most prominent sectors that relate to more than 10.0% of the IS publications. On the other hand, a shortage of IS publications (<0.3%) was noticed that relate to 'Agriculture, Forestry, Fishing and Hunting', 'Mining', 'Utilities', and 'Accommodation and Food Services'. More importantly, the trends presented in Table 8 indicate a growing research interest towards "Finance and Insurance" and "Health Care and Social Assistance", while six of the top prominent sectors have been losing their popularity. In addition to the overall sector-orientation of the discipline, a novel contribution of this study is the determination of prominent sectors in IS journals. Our findings in Figure 1 compare the IS journals regarding their sectoral orientation, while Figure 2 compares the top journals by sector that publish the highest relevant ratio of relevant publications.

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The top sectors identified substantially conform to the information-intensiveness concept argued by Thong and Yap (1995). As the authors noted, the dependency of businesses on information systems and technologies is higher in information-intensive industries and sectors. This argument is firmly confirmed by our findings in Table 5, with an exception for 'Management of Companies and Enterprises'. Accordingly, based on our findings, we note that the research intensity of the IS community is higher in information-intensive sectors.

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KEY TERMS AND DEFINITIONS

EBSCO: EBSCO Information Services is a provider of research databases.

Index Keywords: Keywords assigned by professional indexers, in additional to the original list of author-provided keywords. Each publication listed in EBSCO has a "Subject List" that consist of such keywords.

Industry 4.0: The Fourth Industrial Revolution is the rapid progress in processes and the manufacturing environment, that has been enabled by digital technologies, and transforming the global competition in many industries.

Meta-Data: Data that provides information about data.

NAICS: North American Industry Classification System is an industry classification system that groups businesses with similar production processes.

Scientometrics: Quantitative analysis of scientific literature by measuring and analyzing publications.

SIC: Standard Industry Classification is a taxonomy represents industries with four-digit codes.

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Chapter 9
Digital Transformation in the Digital World the Metaverse: The New Era on the Internet

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ABSTRACT

In this chapter, the author tries to explain the metaverse and identify factors affecting it. The factors were identified as business models, healthcare, leisure activities and social life, economy, ownership, education, freedom or ethic, and art. Each of these creations were affected by the metaverse, and they will be the backbone of building the metaverse. Metaverse is a new phenomenon which is changing the whole digital and physical environment in a very near time. With this respect, the author builds a frame of how the metaverse changes the world. The findings suggested that the economy, marketing, businesses model, and individuals' lives will change dramatically.

INTRODUCTION

According to Zuckerberg, the metaverse is "an embodied internet where instead of just viewing content - you are in it" (BBC News, 2021). The global metaverse market could reach 390-800 billion dollars by the mid-2020s (Duggan, 2021). Companies are investing and preparing themselves for this new phenomenon. Facebook will spend $10 billion (Tan, 2021) on infrastructure, which gives us a hint of how massive it will be.

The information about the Metaverse is so limited because people do not have access to this world yet. However, one certain piece of information about the Metaverse is that this is the new era for the digital world. Until quite recently, people were talking about social media. However, now people are starting to talk about the metaverse. Web-1 had one dimension, and people could not be part of the process. Then, people met Web-2, and it allowed people to participate in the digital world. Social media, one of the biggest novelties for human beings, came with the Web-2. In the late 1960s, Stanley Milgram discovered that anybody who wants to reach someone they do not know has to shake six people's hands. This

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is called Small-world Theory, which is the basis for today's social networks. Thanks to social media, reaching someone one does not know takes seconds. People share their opinion, interact with people, and create content. The usage rate of smartphones has increased recently, which also affects the usage rate of social media. "The smartphone is no longer just a device that we use, it's become the place where we live," says Daniel Miller (Hern, 2021). People easily adapted to the digital world, and most of them cannot live without a smartphone or social media. Today, 4.80 billion people use the internet, 4.48 billion people actively use social media, and 5.27 billion people use mobile phones across the world (We are Social, 2021). Examination of the numbers shows that the adoption of the Metaverse will be quick, so society should be prepared. In the literature, it is thought that every product has a product life cycle. According to the product life cycle, a product is born with labor pains, because companies spend a great deal of time and money. After that, the product grows up, and eventually, it will die. The lifetime varies depending on the product. Therefore, one can say that for the digital world, social media is in its declining phase. The reason is that now a new product is coming which will subvert the old norms. This new product is the Metaverse.

In the Metaverse, people can go shopping, concerts or meet their friends. It will be made up of NFT (non-fungible tokens), Blockchain Technology, AI (Artificial Intelligence), VR (Virtual Reality), augmented reality (AR), Mixed Reality (MR), and Extended Reality (XR) (Thompson Intelligence, 2021). In this chapter, the author will give more detail about these terms. The important question is how these phenomena will affect the market. To explain these effects more clearly, the market as business-to-business (B2B) and business-to-consumer (B2C) will be discussed. The Metaverse will affect every player in the supply chain. Starting from raw materials and semi-raw materials, logistics, production, marketing, and after-sales, services will change. To keep pace, companies will add more value to their processes for the supply chain surplus. As such, the value chain will be more valuable. For example, the Metaverse needs specific tools like virtual reality glasses, headsets, etc. For these tools, production processes have to be flexible and adaptable, and logistics activities and suppliers must be more agile. It can be predicted that consumer needs and wants will change, which will affect demand. For effective marketing strategies, companies should find new methods. Firstly, these Metaverse products will increase competition, so businesses will need to provide an enjoyable experience to the customer. The physical experience will change, and this will affect both products and services. For instance, if a company sells clothes, they will have to adapt their store to the Metaverse so that people can shop in the new digital world. Likewise, if a business provides concert experiences, they will have to adapt their concert stage to the Metaverse. For example, one company adapting to these changes is Nike, which has started investing in the Metaverse and has seven trademark applications (Golden, 2021). According to the definition of the Metaverse, people will reduce outside activities, so companies should start to prepare for this transition.

In conclusion, the Metaverse is the future, and the market should be prepared for this new paradigm. It may seem far from the present, but it is not. Today, many companies have started to invest in this new technology. For instance, a person can buy stocks in Microsoft, Unity Software, Roblox Corp. (RBLX), Amazon.com, Autodesk, and Nvidia (Duggan, 2021). In this chapter, the author will explain this new phenomenon in detail according to the market. The author will discuss the factors which affect the Metaverse in the scope of the market perspective. This is a very new topic, and the author expects that this study will be comprehensive in all respects.

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WHAT IS THE METAVERSE?

The word Metaverse comes from "Meta-universe." As such, one can consider that this is the new universe. The Metaverse will give us a world where people can live through the use of virtual reality technology. This new world is a reflection of the 1992 science fiction novel *Snow Crash* by Neal Stephenson. In the novel, he mentioned digital avatars that people use to explore the online world (Huddleston, 2021). In the book, the Metaverse was a computer-generated 3D (three-dimensional) graphical world where people live as avatars and use their computers to connect with this world through a fiber-optic network (Tasa, and Görgülü, 2010). Today, we are discussing the same things with this book concerning Metaverse. In the Metaverse, people live in a more digital world than the physical world (Cameron, 2012). In this three-dimensional virtual world, people can interact with each other without any physical limitations (Owens, et. al., 2011). It can be seen as beyond reality. However, the companies are starting to take action about Metaverse. In the section named "How will the business be affected by the Metaverse?" these companies are discussed in detail. There are different definitions of the Metaverse. These definitions were presented in Table 1:

Table 1. Definitions of Metaverse

Source	Definition
Chen, X., B., (2022)	"virtual reality and a digital second life"
Snider, M., and Molina, B., (2021)	"It's a combination of multiple elements of technology, including virtual reality, augmented reality and video where users "live" within a digital universe"
Ball, M., (2021)	"The Metaverse is a massively scaled and interoperable network of real-time rendered 3D virtual worlds which can be experienced synchronously and persistently by an effectively unlimited number of users with an individual sense of presence, and with continuity of data, such as identity, history, entitlements, objects, communications, and payments".
Reaume, A. (2022)	"The term 'metaverse' is a portmanteau that combines the words 'meta' and 'universe.' It is used primarily to refer to an anticipated future iteration of the internet that's often hailed as Web 3.0. This evolution of the internet is expected to see the rise of online 3-D or virtually integrated environments that provide users access to virtual reality and augmented reality experiences".
Roy, A. (2022)	"The metaverse can be defined as a simulated digital environment that uses augmented reality (AR), virtual reality (VR), and blockchain, along with concepts from social media, to create spaces for rich user interaction mimicking the real world".

There are many definitions. However, in summary, it can be understood that it is a new, digital world based on digital technologies. It needs a digital environment as Roy, A. (2022) said, and it will be a 3D world. People will live in the digital new world as their avatars. Therefore, there will be a place to live for our avatars. Today, there are some environments in which we can use the Metaverse. One of the most popular is *Second Life*. The Metaverse will provide people a nonphysical "second life." The company LINDEN LAB has created a virtual world, which is called "Second Life" (www.lindenlab.com). It can be considered the starting point toward the Metaverse, and in many papers, various authors have mentioned this website (e.g., Papagiannidis, et. al., 2008; Kumar, et.al., 2008; Boellstorff, 2015; Salmon, 2009; Kemp, and Livingstone, 2006; Kaplan and, Haenlein, 2009; Baker, et.al., 2009). At first look, the website looks like an online game website, but it is more than that. People can join free to this website via computer or smartphone and choose an avatar that reflects them. Installing the applications and joining

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the community is a simple and comprehensible task, and the website looks like the website of an online game. After joining, people can go to music clubs or virtual cinemas, or they can take classes or participate in conferences. The reason why a lot of resources have mentioned *Second Life* when the Metaverse came up is that it is a prototype for understanding the Metaverse. It comes with some changes. First, it removes the geographic obstacle of being somewhere and reduces the cost of learning (Ondrejka, 2007). With the internet, people had already benefited from the advantage of being free from geography. For instance, anyone can attend a meeting from his/her living room. No one has to go to a physical place or another country or city to meet someone as we did before the internet. With *Second Life*, these meetings have become more realistic. Another example is related to learning, as people can easily learn everything via the internet. This will be discussed in this paper in the section named "Education" in detail, but for now, one can say that people can learn everything wherever they want via the internet. However, the ways that the internet improves people's lives will improve with the Metaverse. This is because with the Metaverse, we will be in this new world, and this world can be described as a three-dimensional (3D) world (Arroyo, et. al., 2011). People will be there as their three-dimensional avatars.

Second Life is the most popular platform of the Metaverse. However, there are different platforms similar to *Second Life*. One of them is *Odyssey* (https://www.odyssey.stream/). For six dollars per attendee per day (based on a four-hour event), people can arrange meetings via *Odyssey*. Another environment for the Metaverse is *ZEPETO*. People can create a virtual world on *ZEPETO* (ZEPETO). It seems that in time, these platforms will grow. However, the main idea is being in another world through these platforms. Therefore, they could be connection points between the Metaverse and human beings.

In a summary, the Metaverse is not understood perfectly, because for now, there is a large amount of buzz around it. However, we can say provisionally that, in theory, it is a virtual world based on Augmented Reality (AR), Virtual Reality (VR), and the blockchain where people live with their avatars and will connect to the internet using specific gadgets.

The Key Terms of the Metaverse

To understand the Metaverse, some terms should be clarified. The Metaverse has its characteristics. These are building blocks of this new digital world. Bolger put forward that Metaverse has four characteristics: AR, lifelogging, mirror worlds, and VR (Bolger, 2021). However, according to the author's research, there are more key terms should be discussed as characteristics of the Metaverse, including technologies like AR, VR, and MR that are crucial to participating in this world (Laviola, et. al., 2021). As a result, in this chapter, it is claimed that the characteristics of the Metaverse are AR, Lifelogging, AI, NFT, VR, Blockchain technology, MR, and Mirror world. In Table 2, the definitions of these terms are collected.

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Table 2. Key terms and their definitions

Terms	Definitions
AR	"Augmented reality is that aspect of the Metaverse that gives new eyes to see the material world in an entirely different way. It is similar to lifelogging in that it seeks to add an additional layer of perception to the current experience of reality, and it is similar to mirror worlds in that it continually communicates with sensors in the environment and faces outward to an external world" (Bolger, 2021).
Lifelogging	"As with augmented reality, lifelogging is augmented as well, meaning that technologies are utilized to enhance the current practice of reality—tools are given to build on the current experience of everyday life. Moreover, lifelogging is similar to AR in that wearables will likely be worn (in unobtrusive recording devices) to capture what is going on in people's lives" (Bolger, 2021 coted by Kelly 2016, pp. 278–79).
AI	"The theoretical subject of study of Artificial Intelligence (AI) is cognition, the process that allows a being to perceive what is happening on AI is cognition. On the other hand, the practical purpose of AI is the construction of artificial beings with cognitive abilities, beings who can communicate with humans in natural language and can perform functions that require cognition in a given environment".(Arroyo, et. al., 2011).
NFT	NFTs are cryptographically unique, non-replicable digital assets created through smart contracts (Mofokeng, and Fatima, 2018).
VR	"Virtual Reality (VR) is an advanced, human-computer interface that simulates a realistic environment"(Zheng, et. al., 1998).
Blockchain technology	"Blockchain is a shared, immutable ledger that facilitates the process of recording transactions and tracking assets in a business network. An asset can be tangible (a house, car, cash, land) or intangible (intellectual property, patents, copyrights, branding). Virtually anything of value can be tracked and traded on a blockchain network, reducing risk and cutting costs for all involved" (IBM).
AR	"Sensory overlays of digital information on the real (or even virtual) world, e.g., using head-up displays (HUDs)"(Boulos, and Burden, 2007).
MR	"Mixed reality applications use virtual spaces in which both local and remote users can collaborate. In most cases, such space would contain a photospherical background image or video stream of a real location in which users are placed, and optionally such data as real-world coordinates and the time and date of when the space was created" (Ryskeldiev, et. al., 2018).
Mirror world	"Mirror worlds are informationally-enhanced virtual models or ''reflections'' of the physical world. This world codes external sources such as environmental and geospatial information into the web" (Lee, et.al. 2011).
XR	"The term 'extended reality' (or XR) has been adopted as an umbrella term for VR/MR/AR technologies" (Çöltekin, et. al., 2020).
Virtual world	"In contrast to the existing virtual worlds, the newly-emerging virtual worlds gradually stimulate the economic and social life of physical world communities. The extreme simulation opens up the possibility that individuals can have a second identity in a virtual world" (Lee, et.al., 2011).

The Metaverse has various components, one of which is AI. Today, many people have an idea about AI, as it is not a theoretical phenomenon. There are examples of people using it in practice. Two of the best examples of AI are Siri and Alexa. Both these two applications are available for people and can be used as a personal assistant via a smart device such as a smartphone. AR and VR are important characteristics of the Metaverse. VR is crucial for this new technology because, with virtual reality, this world can be created. Today, consumers can use VR headsets. However, there is a dark side of it, as people can lose the ability to differentiate what is real and not (Murray, 2020). AR, on the other hand, describes technologies that enhance information about the external physical world. This information is layered and networked so that individuals can exploit it (Lee, et.al., 2011). AR is not physically used in real industries since it needs complex equipment (Laviola, et. al., 2021). Another crucial technology is Blockchain. For example, NFTs exist on a blockchain (Ethereum specifically) and have some similarities with cryptocurrencies. However, they are not entirely similar to cryptocurrencies because they are

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not exchangeable (Conti, and Schmidt, 2022). Today, NFTs are very popular and will be explained in this article by examples under the topic of "Art." All of the mentioned terms come together in the virtual world. The 3D virtual world makes people's lives easier. For example, they can control their home devices in the 3D virtual world via the internet (Han, et. al., 2010). There are different types of virtual worlds. These are Massively Multiplayer Online Games (MMOGs), Metaverse, seamless persistent world, user-generated content and massive, and dynamic content. Online games are an environment that must be connected via the internet to a system. One example is MMOGs, which have become popular. In these games, hundreds to thousands of players engage with one game at the same time. Meanwhile, the Metaverse is a digital universe, distinct from online games, and it also is massive. Metaverse presents a transparent seamless persistent world without any borders whose contents are generated by users (Kumar, et. al., 2008).

The Cornerstones of the Metaverse

In this chapter, the author attempts to explain the whole framework of the Metaverse. In reality, it will change many things in people's lives. In the following section, the cornerstones of the Metaverse are Freedom or Ethics, Economy, and Leisure Activities (Papagiannidis, 2008) Here, business models and the art of the Metaverse will be explained in detail.

Freedom or Ethics

In Web-2, i.e., social media, people's every move is recorded as data, which produces the term "big data." Big data can be defined as "data sets whose size or type is beyond the ability of traditional relational databases to capture, manage and process the data with low latency. Characteristics of big data include high volume, high velocity, and high variety" (IBM). In the Metaverse, the private sector and the government will continue to collect the people's every move as data. However, in this case, the data will be more personal and reflect us in greater detail. For example, Barry et. al. (2015) experimented with the *Second Life*. In this experiment, they had a virtual problem-based learning (PBL) class in Metaverse and asked simple and difficult problems to participate students. According to their results, the difficult problems made students' feelings unstable and increased the number of times students blinked (Barry et. al. 2015). This experiment states that concerned people can understand a person's feelings, including feelings in difficult situations from blinking. This could be an obstacle to people's freedom in the future.

In the social media and digital age, the meaning of privacy is changing. Today, data is everything, and many companies use this data to understand their customers, and ethical problems accompany this issue. Today, there are laws for protecting personal data, but authorities described these as insufficient. When the Metaverse enters people's lives permanently, ethical problems could arise just like in the earlier eras of the internet. Perhaps, for this new era, actions aiming to protect people's personal lives should come earlier.

Education

In the environment of the Metaverse, education could be different compared with today's education. According to the literature, education will become easier than it is now. With this new technology, geographic obstacles will not be a problem, which will benefit those living in places that are far from

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the schools or have no transportation. It will be a useful way to deliver education to many people. With the virtual community, learning a new language, for instance, will be very easy (Liu, and Zhang, 2012).

Furthermore, the Metaverse is also convenient for Science, Technology, Engineering, and Mathematics (STEM) education according to Kanematsu et. al. (2014)'s study. They conducted a radioactivity course in *Second Life*, and according to their results, participating students said that this kind of education satisfies both STEM education and nuclear safety education at early (pre-secondary) levels (Kanematsu et. al. 2014). In some areas, simulations are crucial, as some industries present safety hazards. Because of this, people could participate in businesses like radiation research or aviation. According to Siyaev, and Jo, (2021), Aircraft Maintenance Metaverse is a cheap and scalable solution. As such, for aviation, this would be an improvement.

Park, et. al. (2021), experimented on 91 university students. These students attend a class that uses gamification for learning. They describe four types of players: Achievers, Explorers, Socializers, and Killers, and their research showed that there is no difference between players based on motivation. As a result, gameful experiences, rules, and strategies are suggested as important factors in gamification design (Park, et. al., 2021). With the Game-Based Learning (GBL), the Metaverse could be a supportive place (Getchell, at. al., 2010). Another example is from the Faculty of Systems Engineering of the University of Cundinamarca. They used "virtual Moodle" to support students and instructors. In this case, the results were positive both for students' learning and instructors' teaching (Díaz, 2020). By using this technology, people can get a college experience. According to the study's results, young people are satisfied with living the college experience in the virtual world (Sébastien, et. al., 2018).

However, there is one problem with virtual classes. Crespo et. al. (2013) found that connection problems occur when the number of participants exceeds twenty-five. However, there is no other negative evidence. As a whole, it seems that for education, the Metaverse could be a breakthrough.

Ownership

In the virtual world, ownership is an important problem because there is no legal authority such as a government or laws to protect people's belongings. When somebody steals somebody else's avatar or the materials belonging to them, there is no place for the victim to complain about the situation.

Today, in the Metaverse, people can buy land as in the physical world. The Sandbox, Decentraland, CryptoVoxels, and Somnium Space are the biggest providers of these services, and they sell properties valued at one hundred million USD, and that value is increasing. One of these lands sold for 4.3 million USD (Yagcı, 2022). The market reached €440 million in 2021, and it is estimated that this number will double in 2022 (Chúláin, 2022). This is a huge investment. Besides land investment, real estate investments also have reached high numbers. Tokens.com spent almost $2.5 million on a patch of land in Decentraland, and they said they estimated the prices will rise 400% to 500% in a couple of months. Meanwhile, Republic Realm spent a record $4.3 million on a parcel of virtual land in the Sandbox (Dilella, and Day, 2022). If anyone wants to buy land, they will be ensured by a unique piece of code stored on a blockchain. This code cannot be changed and certifies an individual's rights over a digital asset (Chúláin, 2022). Buying an NFT also works like this. In some ways, it can be trustworthy, because blockchain technology is considered as solid and secure (Bashir, 2017). In other ways, these systems are not based on an authority like a government, meaning that when a person loses his whole investment in this system, there is nowhere to seek legal recourse. Even if the companies have their agreement, it

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could not compare with a legal authority such as a government. Therefore, until there is greater stability, there will always be risks related to ownership.

Economy

Every improvement in the world can affect the economy. When the internet spread all over the world, people wanted to use this service for themselves, and they paid money for it. When some people saw this demand, they started to open companies and supply digital or technological services. According to Forbes, the first five most valuable brands are from the technology sectors (https://www.forbes.com/powerful-brands/list/). Technology has a massive impact on the economy all over the world. These effects will be continued with Metaverse, and today, many large companies are starting to invest in this technology. For instance, a person can buy stocks in Microsoft, Unity Software, Roblox Corp. (RBLX), Amazon.com, Autodesk, and Nvidia (Duggan, 2021).

The meaning of currency is also evolving. In the past, people had to have tangible things to exchange. That was the way to have property. Over time, they started to use metals like gold and silver to buy things. Finally, human beings created money, which we use today. Money is a tangible thing that we exchange. However, over time, people changed their habits about carrying money. Debit or credit cards have taken the place of the physical currency, and intangibility begins to take the place of tangibility. Money became digitized, and the term "digital economies" started to be discussed. As a term, the digital economy does not have a clear definition (Bukht, Heeks, 2017). To understand the logic behind this term, it can be helpful to define "digital" first. According to Merriam-Webster (2022), "digital" means:

1. "of, relating to, or utilizing devices constructed or working by the methods or principles of electronics: ELECTRONIC, also: characterized by electronic and especially computerized technology"
2. "composed of data in the form of especially binary digits"

From the definition, the digital is composed of binary digits, and as such, in the digital economies, one can also say that it is based on binary digits, which are symbols. Accordingly, we deduce that money is now symbolic for humans. Because of this, people adopt cryptocurrencies easily. Cryptocurrencies are part of this new technological era, and they may be a currency for the Metaverse. For example, in *Second Life*, people have to use a currency whose exchange rate is controlled by Linden Labs (Papagiannidis, 2008).

Leisure Activities and Social Life

With the internet, leisure activities have changed. Today, social media is the biggest part of the lives of people of all ages, as almost everyone has at least one social media account. Today, 4.48 billion people actively use social media across the world (We are Social, 2021). Besides social media, people can shop easily, order food, handle their bank activities, pay bills, check news around the world, learn whatever they want, and even control their daily steps thanks to the internet. With the internet, people's lives have gotten easier in some respects, and people transfer their daily activities to the digital world. This changed people's social life fundamentally. The internet gives people the ability to share and interact with others, and with the Metaverse, people will be part of a new world as a 3D version of themselves.

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Before the internet, children or young adults spent their time outside, but now, they are all inside playing online games. These online games have improved over time and have come to be a type of virtual world. In particular, MMOGs are very popular among young people. Playing a game is only one part of this experience. In addition to simply playing, users engage with each other and become part of a community. Perhaps, the feeling that they belong somewhere else makes these games attractive. Besides games, gambling is also in demand in the virtual world. However, it brings legal and ethical questions with it (Samlasi, and Gillam, 2009). Samlasi and Gillam, (2009) discuss the design of EthiCasino and they highlighted that the responsibility could be shared between the casinos and users to find a solution to legal and ethical problems.

The Metaverse is a virtual world. According to Jun (2020), some things in human lives accelerate the adoption of digital novelties. For human beings, there is now a new normal. The COVID-19 pandemic and Industrial 4.0 have brought that new normal, and the new normal has affected many things, even religious activities (Jun, 2020). Already, virtual reality has provided people with a variety of things. These things can be spiritual things like religious activities or material things like houses, sculptures, money, land, etc. In the virtual world, virtual architecture will start to be a topic of discussion, a process that has already started (Ib'ñez and Naya, 2012).

Healthcare

In the world, healthcare services are a massive and pressing problem (Nguyen, and Montemanni, 2016). People do not get the proper service in many countries. A major reason for this is money (Petrila, 1995), as in many countries, the government does not provide free healthcare services for the public. If people do not have enough money, they cannot afford decent healthcare services, and subsequently, people can become seriously ill, or even worse, they could die. Another crucial factor is related to the problem of manpower. The number of doctors is not adequate for the number of people who get sick every day (Lowrey, and Pear, 2012). This reality was evident throughout the COVID-19 pandemic. This problem affects the time that doctors care for their patients. Today, in-state hospitals, doctors state that they have three and a half minutes to examine a patient and diagnose them. To solve this problem, countries are now trying to provide long distance health care services. The Metaverse may be a breakthrough in healthcare services as a solution to these problems (Thomason, 2021). Ko and Jang (2014) wrote about how they provide health care services to seniors via Metaverse in Korea, and they suggested that the Metaverse experience in the healthcare services will be positive.

Business Models

The virtual worlds provide new opportunities to businesses, including product design, virtual tourism, spacial and environment aesthetics, social exchange, and innovation-based simulations (Zhou, 2018). Zhou, M., et.al., (2018) collected data from actual court cases, data from discussion boards, expert commentary, interviews, news items, and blogs and analyzed this data to understand ownership in the virtual world. They found that a platform's ownership rights supported a new business model. The current structures around ownership rights and control seem to not be beneficial in the long term. According to Wunderman Thompson, "with consumers increasingly assigning value to digital assets, new direct-to-avatar (D2A) business models are on the rise, augmenting existing digital shopping experiences" (www.wundermanthompson.com/campaign/). Shopping is the most important part of a human's social life.

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This is because people have infinite needs. As long as human beings continue to exist, these needs will continue to exist. Because of this, retailing is the most important sector in the world, as it provides the things people need. This is the reason that retailing is improving in parallel with technology. Therefore, it can be understood that the Metaverse will affect these sectors. According to Bourlakis, et. al. (2009), in the Metaverse, retailers need to employ a holistic and overarching approach to promotional strategies, and they recommend that the retailers, there is an immediate need for policy development dealing with the Metaverse (Bourlakis, et. al., 2009).

According to this chapter, some sectors, including retails, health care, architecture, education, etc., will be affected by the Metaverse dramatically If predictions about the Metaverse come true, then some business models will be changed permanently. For example, people will not go to a cafe to meet their friends or go out to places like the gym because they will not need to. Additionally, other sectors may be influenced by this new technology. For example, Brennen and Dela Cerna (2010) discussed journalism in *Second Life* in their study. They suggested that it focuses on community building and education (Brennen, and Dela Cerna, 2010). Overall, businesses should follow these innovations closely. Just as every company has a social media account today, soon, being in the Metaverse will be the default for companies, too.

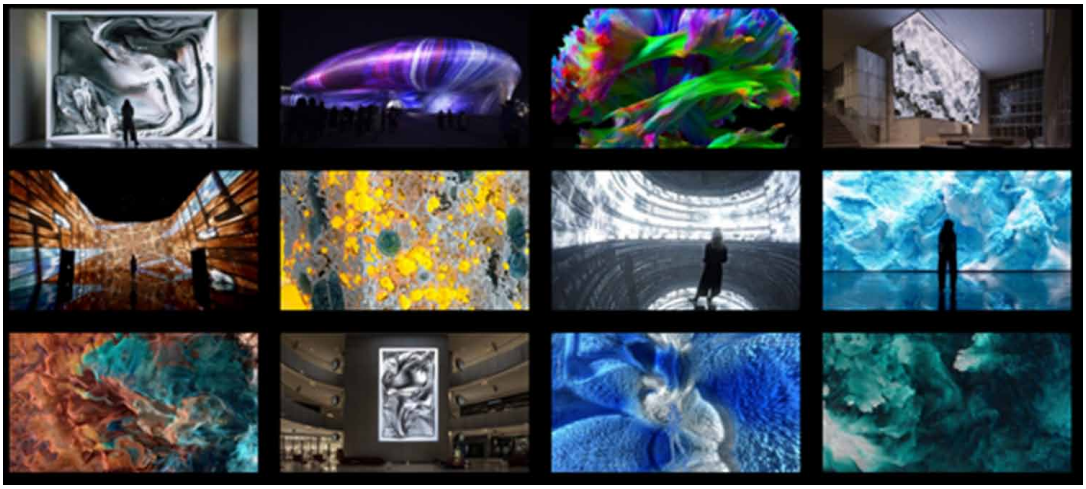
Art

Technology has a large effect on art. It starts with digital museums, 3D displays, laser shows, online promotions, etc. Because of art's dynamic nature, inevitably, the Metaverse effects on art too. Additionally, the pandemic is accelerating these transformations. Today, people can go to a museum with their phones without actually going there. The museums have evolved from traditional museums into digital museums (Choi and Kim, 2017), and in the Metaverse, one can go to the museum or create an artifact (Tasa and Görgülü, 2010; Ando, et. al., 2013).

Besides museums, pieces in museums are also affected by this transformation. With the Metaverse, art will change dramatically, and this dramatic change is already starting today. One of the best things in art is NFTs, which have been brought into our world along with the Metaverse and AI. NFTs are blockchain-based assets and have become popular and attractive for inventors (Chohan, 2021). For example, a young artist, Refik Anadol, connected data and art and created global masterpieces. He is a lecturer at UCLA (University of California, Los Angeles) and uses artificial intelligence to turn a place like a building into a piece of art. In Figure 1, there are some examples from his work.

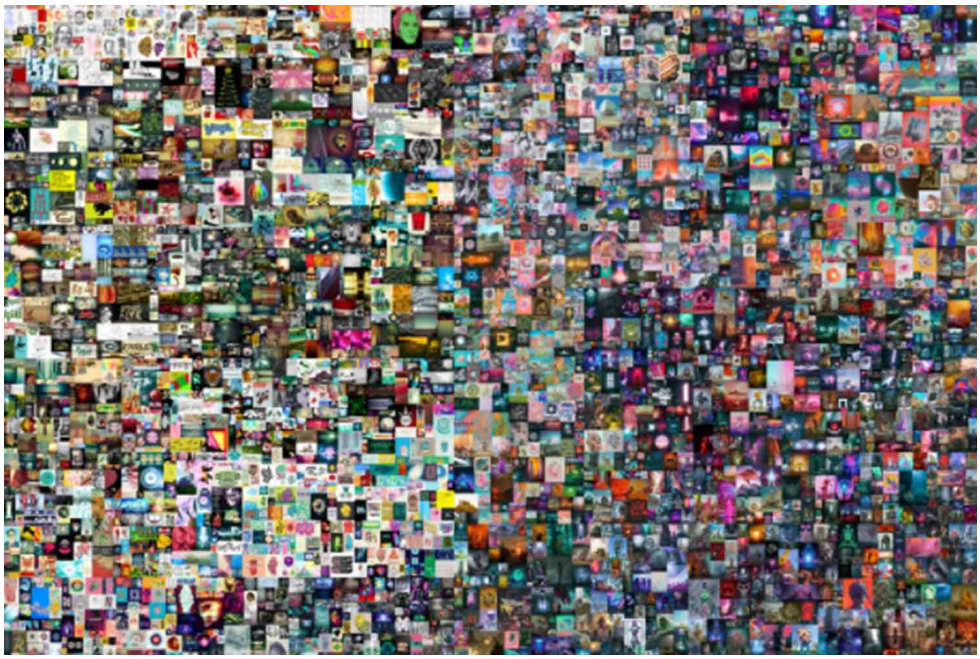
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Figure 1. Refik Anadol's works
***Source**: https://refikanadol.com/*



Besides artificial intelligence, he is also creating NFTs which are very popular in the modern world. In 2021, there was an auction in which one piece of art was appraised at a sum of $69.3 million. This work is just a JPEG file made by Beeple (Kugler, 2021). Beeple is Mike Winkelmann, a graphic designer who creates a variety of digital artwork, including short films, Creative Commons VJ loops, every day, and VR / AR work (https://beeple-collect.com/about/). The piece is shown in Figure 2:

Figure 2. Beeple's "Everydays—The First 5,000 Days
***Source**: https://www.theverge.com/2021/3/11/22325054/beeple-christies-nft-sale-cost-everydays-69-million*



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People can buy and sell these art pieces online. NFTs started to be discussed in 2014, and $174 million has been spent on them since November 2017 (Conti, and Schmidt, 2022). Today, many famous people are joining this world with their NFT series. These people include famous people such as Reese Witherspoon, Eva Longoria, Shonda Rhimes, and Gwyneth Paltrow (Goldstein, 2022). Therefore, it is evident that NFTs are a growing trend. Art is a very important part of human life. Humans need to express their emotions specifically, and art is the easiest way to do so. Additionally, art is a good and common way to invest. A lot of investors are following developments in this area. On account of these two reasons, art will live forever, and with each year, its value will increase. Furthermore, it is developing with technology. Today, art is valuable, and tomorrow, it will be more valuable based on the money spent on NFTs up to the present day.

RESULTS

How Will the Business be Affected by the Metaverse?

The Metaverse has affected the market. It is estimated that shortly, the digital world could grow into a $1 trillion business (Dilella and Day, 2022). In every sector, companies try to be up to date. There are many examples of companies investing in the Metaverse. For instance, Wunderman Thompson collaborated with the Odyssey and started a Metaverse experience. They describe it as "Our branded metaverse experience will examine the meta-trends that impact consumers through the creation of MetaLives, MetaSpaces, MetaBusiness, and MetaSocieties" (Wundermanthompson.com). Hyundai is preparing for *metamobility*. They described Metamobility as "'Metamobility', to pioneer a smart device-metaverse connection that will expand the role of mobility to virtual reality (VR), ultimately allowing people to overcome the physical limitations of movement in time and space." With this concept, they expect to go beyond physical movements through robotics. The company claims that the future of mobility will change with the robotics-based Mobility of Things (MoT) ecosystem and the Metaverse (www.hyundai.com). Procter and Gamble is another company taking a step towards Metaverse at CES 2022. Procter and Gamble is one of the biggest companies in the world and has many brands under its umbrella. They provide a virtual experience called LifeLab (Procter and Gamble). Samsung is a technology company that produces a variety of products from home appliances to smartphones. The firm launched *My House* on *ZEPETO*. According to Samsung, the Metaverse is the way to reach Generation Z, and within this environment, people can decorate their own homes (Samsung). Facebook will spend $10 billion (Tan, 2021). Microsoft, Unity Software, Roblox Corp. (RBLX), Amazon.com, Autodesk, Nvidia (Duggan, 2021), Nike, Adidas, and HandM are other companies (techgig.com) participating in this new phenomenon. That means Metaverse affects both the Business to Business Market (B2B) and the Business to Consumer Market (B2C). In the next section, the effect of the Metaverse on these two markets will be discussed in detail.

Business to Consumer Market (B2C)

There are two types of markets. One of them is the B2C market. It means businesses trying to reach consumers. According to Kotler (2012), in the main marketing process, companies' main goal should be to capture value from customers. Customers are very important for the companies because there are

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many offers on the market. Because of that, to survive in the market, companies must build long-term relationships with their customers, and to do so, they must listen to customer voices. To understand customer needs and wants, companies must follow new technological developments. Otherwise, customers will change their preferences in favor of those companies that follow novelties. Consumers will adopt the Metaverse easily and participate in that world. Therefore, companies should be in this new world for their customers and potential customers. It can be inferred from previous experiences that if companies will not be a part of the Metaverse, they could lose market share easily.

Business to Business Market (B2B)

Metaverse technology could affect the whole supply chain (Bourlakis, et. al., 2009). Like with the Internet of Things and Industry 4.0, the whole supply chain process could be adopted to the Metaverse. Firstly, the product in the production could be changed. Then, demand would change. While participating in the Metaverse, people would need specific gadgets like headsets, and naturally, the demand for this product would increase, affecting the demand for raw materials and semi-raw materials needed to produce this product. These specific products are needed for a specific production process, and these processes could be required to add more value than now.

The world will be more digitized with the Metaverse. Because of this, demand for smart things may increase or change. Usage of cloud technology would increase. People may need communication infrastructure, and cybersecurity will become more important. These are merely predictions, but they are set to influence the B2B market if they come true. Furthermore, they will also affect the people who work in these sectors. Therefore, these sectors should prepare for the Metaverse and start to invest in infrastructure and manpower.

CONCLUSION

Humanity has been affected by many innovations throughout history, including fire, the wheel, the telephone, the internet, etc. All of these innovations made people's lives easier. For instance, with the invention of fire, people gained the ability to receive external heat and cook. However, the internet has been the biggest innovation in human life in recent times. With the internet, the new world's doors are open. In the beginning, it was strange for people, and only some specific organizations like universities or governments had access to the internet. Over time, however, every home came to have an internet connection. At first, people used bulky computers to use the internet connection. Eventually, the quality of internet connections improved, and computers became smaller. Although the digital world was at first defined by reading text, it eventually turned into a two-dimensional world. In addition, gadgets such as computers which access that new world developed and evolved, too. Computers lost their cables and have got smaller, thinner, and lighter. With these new gadgets, people started to access the internet whenever or wherever they wanted because the internet lost its cable connection, becoming "wireless." All this, however, was not enough for people, so they wanted to carry their phones with them and connect their phones wirelessly. In accordance with these desires, smartphones were born. Today, nearly everyone has a smartphone with an internet connection, and it is natural for people today. However, all of these innovations occurred in a short time. Despite this, human beings adopted these novelties very quickly.

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Recently, in 2021, buzz over new technology has increased all over the world. The most famous social media platform owner renamed his brands, and discussions about the Metaverse became heated. To understand how this buzz is affecting people, firstly, one must understand social media. In the first paragraph, it was mentioned that the digital world evolved into a two-dimensional world, and social media became the most important way for people to be part of this world. Via a social media provider, people create accounts that reflect their personality or who they want to be. To connect to social media, people just use their computers or smartphones and post two-dimensional pictures. The most popular social media websites are Instagram and Facebook, and their owner renamed their parent brand as Meta. Following this change, a discussion of the Metaverse exploded.

Now, everyone is trying to understand the Metaverse. There are many definitions for it. Referencing the definitions in this chapter, we can state that the Metaverse is a 3D version of social media. However, it is not that simple. The important point is that it is not the 3D version of social media, but rather, a three-dimensional version of the internet. It is a new world for human beings rendered in three dimensions. This change means that like the effect of the invention of the internet, this breakthrough will affect people's lives deeply. There are just predictions about these changes for now. However, businesses are nonetheless starting to invest as discussed in this chapter because they do not want to be behind in this new era. In the future, consumer demand will change as people's lives will also change. This new era started recently with the COVID-19 pandemic. People are now staying at home, and it is predicted that with the Metaverse, they will not need to go outside. They could access everything literally from their couch. Accordingly, this new world will come with new habits. When individuals change, businesses will change, too, and large companies are preparing and will continue preparing for this change. In summary, the new age is coming, and this new age is a digital transformation in the digital world.

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Chapter 10
Understanding Adoption of Accounting Software in Business Sectors at Kathmandu Valley:
Evidence From Structural Equation Modelling

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ABSTRACT

The aim of this study is to determine the influence of knowledge and use of accounting software (AS) among small business (SB), medium scale industry, cottage industry, entrepreneurship, and informal sectors in Kathmandu Valley. This study has used structured questionnaire with an interview. The data were evaluated quantitatively by using both descriptive and inferential statistics. Based on practical experience and basic knowledge in the field of accounting, a total of 210 members are selected as the sample size for the study. The findings revealed that the knowledge of AS has a significant effect on the use of AS, meaning that there is significant and positive relationship among the knowledge of generalized AS and the use of such customized AS by business in Kathmandu Valley. In addition, this study shows the empirical evidence of knowledge of AS effects on the adoption of AS among business sectors in Kathmandu Valley. The use of AS has resulted in a significant impact on business in developing countries like Nepal.

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INTRODUCTION

Background

The growing globalization of the world economy has attracted businesses from all over the world to compete in the global markets, leading to a new series of accounting problems, such as various currencies, and a multitude of accounting and tax laws (Boulianne, 2014). The tradition of accounting is vivid and fascinating (Reform & Path, 2019). Though today's companies depend more on modern processes, early corporate and financial transactions began on clay tablets. Today, automated technology is used for data analysis, confirmation, matching and more in various accounts payable organizations (Rijanto, 2021). Explore the persuasive evolution of accounting tools to figure out how to play a game of numbers. The scope of the responsibility of management accountants is shifting from merely reporting the aggregated historical significance to now include the measurement of organizational performance and the provision of management decision-making expertise (Tiron-Tudor & Deliu, 2021).

There is also an increasing need for a more sophisticated accounting software kit that can address complicated international accounting problems (Carlson et al., 2019). Various small and medium-sized firms have gradually started to use various accounting software to manage financial reports effectively and to increase operational efficiency and operating profit in the Asian community (Ahmed & Sarim, 2017). It also helped them improve accounting performance, speed of completion, decreased overall costs, timely reporting and reduced frustration with tax filings. (Hosain, 2019). Corporate information systems such as enterprise resource planning (ERP) systems have provided both improved data gathering capacity and enhanced processing power to accountants. With massive data derived from both internal and external data sources, accountants will also use data mining tools to address questions such as: what has happened? What is about to happen? And what is an optimal approach by use of accounting software such ERP? (Appelbaum, Kogan, Vasarhelyi, & Yan, 2017).

Barrett et al. (2010) computerized accounting software as "predominantly used to prepare financial statements such as the balance sheet (78%), benefit and loss statement (76%), and cash flow statement (63%)". In a Heikkila survey of small companies in Finland, 85 percent of respondents used an accounting kit. Similarly, in a study of IT usage of small companies conducted in the United Kingdom in 1998, 86% of the 800 respondents claimed they had computerized their accounting systems. In 2001, 77 percent of New Zealanders used computerized accounting programs to complete their accounts. These numbers must have skyrocketed in the past five years (Pulakanam & Suraweera, 2010).

Today, there are large numbers of small and mediums enterprise being established in various landscape of Nepal (Mahat et al., 2019). There is favourable government policy in the support for entrepreneurship and youth for commencement of business. So, Accounting Software is need for making business systematic. There are many examples of failure of business due to lack of proper accounting recording of business activities (Gnawali, 2017). For making prudent financial recording and activities of the organization, adoption of Accounting Software is must which can play a pivotal role in managing financial report (Yang, 2021).

According to Thakur et al. (2020) in Nepal Accounting Software have a variety of elements such as economics and manufacturing, human capital, distribution, data incorporation based on market operations, and it can also be modified on-demand or to meet the individual needs of an enterprise. ERP systems allow database sharing in separate business units with various orientations based on divisions such as accounting and sales, and use the same information for their needs (Boonstra, 2022).

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In world the accounting started from bookkeeping in which all the accounting activities were done manually (Mari, 2020). All the companies and industries do their activities on manual basis but it was very risky and time consuming to make forecast for future that risk bring the change in accounting pattern. Managers and businessman started to bring computerize system by using different accounting software. It is because with increase in business from national market to international market. Which brings more areas in business which is not possible to make manual and cope with the international markets. So, to make simple and easy accounting software plays the vital role (Bash, 2015). The development of accounting software and package started from the inventory control system and now there is advance use of enterprise resources planning (ERP) and digitalization in the accounting department. Even different nations are using the e-accounting systems in government areas in Asian and European to American countries. To cope with such issue government are planning to implement computerized accounting system study in college and universities (Tarhini et al, 2015).

Different theories have been interlinked with the concept of accounting software to provide theoretical framework. This part of study includes different theories concerned with accounting software and its initiatives, practices and policies (Grant & Osanloo, 2014). Various theories were reviewed in order to find out the relatable variables and concepts for the research. Organizational Theory, Theory X and Theory Y, Theory of Planned Behavior, Diffusion of Innovations Theory and Unified Theory of Acceptance and Use of Technology (UTAUT). The conceptual framework illustrates what you want to discover in your study which describes the related variables for your analysis and maps how they might contribute to each other (Hong, 2019). It has been stated that the conceptual framework needs to be developed in a context in which the study is conducted stating that it is dependent and independent variable and the relationship between them. Therefore, the researcher can explore the key concepts of Accounting Software in the light of current, selected and appropriate theories which will add more sensation and understanding to the field of Accounting Software.

Accounting software is designed on the basis of particular needs and objectives. Company solutions can help reduce the cost of human capital and maximize total efficiency. Start-ups change accounting programs to improve strategic benefits in order to grow into mid-sized and large corporations (Lee, 1996). It shows how software has been developed from bookkeeping to cloud computing with the requirement of business environment. The Accounting Software has played vital role in improving the accounting activities, which reduced different unwanted cost and provided information to business firm to perform their in a systematic way (Kokina, 2019). All Asian countries are enrolled in providing education of such software. Arab and Gulf nation are giving important in adopting advance accounting software and government providing different facilities to achieve that target (Rahman, 2021).

Technology plays an integral role in the real world, adopting an optimal approach when designing accounting software to meet the project goal (Sadeghi et. al., 2022). Nepal appears to lag behind. While taking about small strides in technical development, through e-commerce, digital wallet, Internet broadband, online enterprise, gaming, entertainment and many more, are going in the same direction to encourage individuals with all the new technology trends (Modgil et. al, 2022). In order to satisfy the software demands of consumers, numerous small, medium and large software companies are developing in Nepal. So, to meet such target promotion strategy should be done by the government. Like different facilities are provided to hydropower industry in that way different Accounting Software should be given more importance.

This is a novel concept in the Nepalese market. Several questions have been emerged in the regarding of Accounting Software in context of Nepal, which need to be answered like. What is the acceptance

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and use of Accounting Software in business sectors of Kathmandu valley? What are the challenges faced by employees in adoption of Accounting Software? What are the most effective managerial solution for adoption of Accounting Software? Hereby, this study tires to cover the present status of perception about the use of Accounting Software in Nepalese context that include several benefits, challenges associated with its policies and measure that need to be taken to promote Accounting Software and IT in business sectors.

Thus, a proper assessment is required to explore these questions in the context of managerial and employee's perception towards the adoption of Accounting Software. This study aims to understand adoption of Accounting Software in business sectors at Kathmandu valley.

This, paper is organized as follows: the following section describes the methodology used in this study. After that, in the following section, this study presents the results according to socio-demographics features.

RESEARCH METHOD

Theoretical Framework

The theories of Accounting Software paly vital role in getting better perspective on the adaptation of Accounting Software (Braidotti, 2019). As this study is to analyse the adoption intention of employees towards Accounting Software these theories helped to get better understanding about what factors affect the adoption of the computerized software and what motivate them to take certain decisions and act in a certain way. In this research five theory has been included that are Organization Theory (Hoffman et al., 1970), Theory X and Theory Y (Cunningham, 2011), The Diffusion of Innovation Theory (Nyamwanza, 2014), Theory of Planned Behaviour (TPB) (Chen & Yang, 2019) and Unified Theory of Acceptance and Use of Technology (UTAUT) (Taherdoost, 2018). From among this theory UTAUT theory was selected as it explains that the adoption of new technologies highly depends upon the different factors such as performance expectancy, effort expectancy, social influence and facilitating condition (Almaiah et al, 2019).

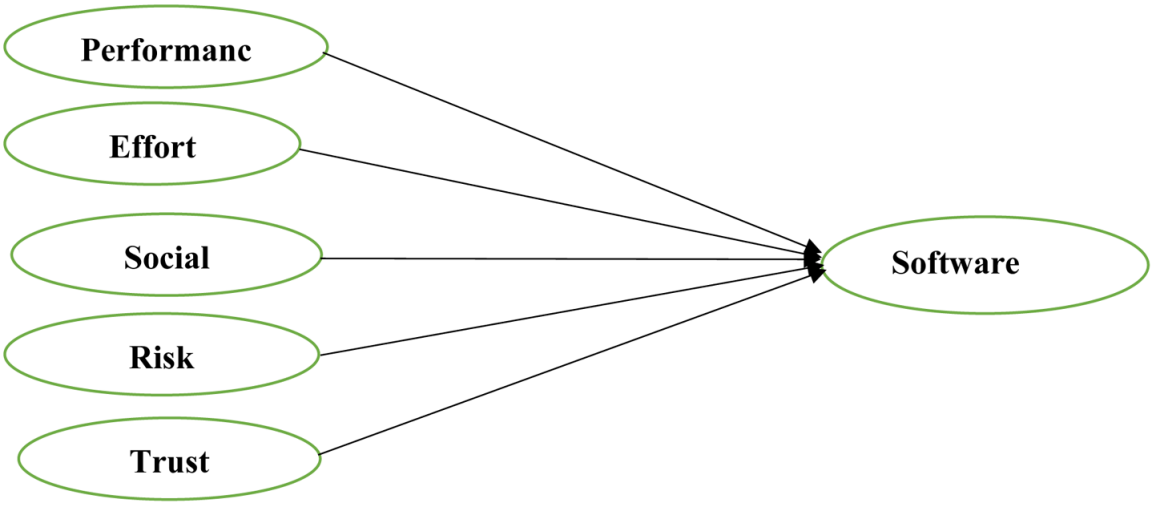
Conceptual Framework

The UTAUT model helps in understanding the drivers of mobile banking adoption, technology/software adoption and wireless commerce (Almaiah et al, 2019). In figure 1 the UTAUT model is based on identify the adoption intention of employees on the basis of PE, EE, SI, R and T. Moreover, UTAUT and its expanded theoretical frameworks are commonly used to predict behavioral intentions for technology adoption.

Within the framework of the UTAUT model, the above conceptual framework attempts to understand the drivers of Accounting Software adoption (Malik, 2020). It consists of five independent variables and one dependent variable. Namely; Performance Expectancy, Effort Expectancy, Social influence, Risk and Trust and adoption Intention of Accounting Software by business sectors in Kathmandu valley respectively (Sarfaraz, 2017).

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Figure 1. Conceptual Framework
Source: Modified from Sarfaraz (2017)



Hypotheses Formulation

Performance Expectancy (PE) and Software Adoption Intention

The user's expectation of technology performance affects his decision to implement the technology. Previous research has shown that perceived performance has an impact on behavioral intention to implement Accounting Software (Rahi et al, 2019). According to Sripalawat et al. (2011) researchers from various geographical locations and domains discovered that performance expectation is an important factor in helping users shape their behavioral intentions. The following hypothesis is set by the researcher to adopt software in lining with Performance expectancy in business sector.

- H1: Performance expectancy predicts software adoption intention of organization.

Effort Expectance (EE) and Software Adoption Intention

Experts in technology adoption models emphasized that user perception of ease-of-use dictates technology acceptance (Luarn & Lin, 2005). One of the primary reasons Accounting Software users implement the technology is because it is simple to use and requires little effort. By delivering a user-friendly interface and a swift accounting process, the service is intended to make their lives easier. Many academics have previously investigated the concept (Rahi et al, 2019). Likewise, this study presents the following hypothesis about effort expectancy when it comes to software adoption intention in business sector.

- H2: Effort expectancy predicts software adoption intention of organization.

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Social Influence (SI) and Software Adoption Intention

According to Ciranka & Bos (2019) the decision to implement Accounting Software was influenced by close friends and family. Humans cannot disregard the social impact in their daily lives because they are a part of their surroundings (Jaques et al., 2019). People adopt because they want to fit in or communicate, and research on creativity adoption back this up (Pedersen & Ling, 2003). Similarly, this study presents the following hypothesis about social influence when it comes to software adoption intention in business sector.

- H3: Social influence predicts software adoption intention of organization.

Risk Perception (RP) and Software Adoption Intention

People's willingness to use accounting software is influenced by their perception of the risk associated with its implementation (Cori et al, 2020). People are naturally resistant to change and stepping outside of their comfort zone. As a result, they are hesitant to pursue opportunities because they are concerned about extra security risks or a loss of privacy (Siegrist, 2019). Thus, this study presents the following hypothesis about risk perception when it comes to software adoption intention in business sector.

- H4: Risk perception predicts software adoption intention of organization.

Trust Factor (TP) and Software Adoption Intention

The acceptance of technology is heavily reliant on trust. The system's dependability and availability when the user requires the service is an essential factor influencing the adoption of such services (Siegrist, 2019). Hereby, this study presents the following hypothesis about trust factor when it comes to software adoption intention in business sector.

- H5: Trust factor predicts software adoption intention of organization.

Study Area and Population

This thesis uses an explanatory analysis design. The area chosen for the study is Kathmandu valley. The Kathmandu valley comprised of three districts namely Kathmandu, Lalitpur and Bhaktapur which is located in Bagmati province of Nepal (Roskosky et al, Ali, 2021). Kathmandu is the largest city in Nepal with the population of around 1.47 million people (Lamichhane & Shakya, 2019). Kathmandu valley lies between the latitudes 27°32‟13” and 27°49‟10” north and longitudes 85°11‟38” and 85°31‟38” east. It is located at a mean elevation of about 1300 meters (4265 feet) above sea level in the bowl-shaped. Kathmandu valley covers an area of 395 km2 (Thapa & Murayama, 2010).

Kathmandu Valley is chosen for the study area as it is a hub for a variety of major industries, including carpets, clothing, finance, tourism, health, educational, and banking services. Due to a lack of infrastructure growth and services in other parts of Nepal, Kathmandu valley is quickly becoming a hub for many enterprise and service activities. Nepal's private sector is expanding at the moment (Timsina, 2020). In addition, the Kathmandu valley is home to the offices of all industry industries (Sharma et

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al, 2020). The sample size was determined by using n= z 2 pq/l 2 (Agufa, 2016) as formula and the calculated sample size is 280.12(»280) for this study but due to COVID, lockdown and lack of time to employees after lockdown only 210 respondents are taken as the sample size.

Instrument, Procedure of Data Collection, and Data Analysis

The main research instrument in this study was a structured questionnaire with an interview. A structured questionnaire has been developed and designed to conduct a survey on Accounting Software practices in business sectors in order to collect data an interview was conducted with the employees of Kathmandu Valley's business sectors and Interviews were used to collect quantitative data. In order to meet the study's various objectives, the researchers created a linked questionnaire. The structured questionnaires that have been developed and are kept in the kobo toolbox for data collection it is because it is an offline and online medium from which the researcher can easily send the questioners. From 210 respondent's data 60% to 70% data were collected by face-to-face interview whereas remaining were send through enumerator and collected.

The collected data are further analysed to find out the solution to the problem. Both descriptive and inferential analysis method is used for the analysis of data to determine the influence of knowledge and use of Accounting Software (AS) among small business (SB), medium scale industry, cottage industry, entrepreneurship and informal sectors in Kathmandu valley. Analysis consisting of structural equation modelling based on several latent constructions. Descriptive data used to describe the nature and characteristics of data to understand the subject of the study by using mean, median and standard deviation. The results of the statistical analysis of the data are displayed in a variety of tables and graphs. STATA, SPSS and AMOS are some of the applications used for the inferential analysis of data Factor Analysis to Structural Equation Modelling (SEM) are also used for the analysis using Likert scale for this study.

RESULTS AND ANALYSIS

Socio-Demographic

Table 1 shows the socio-demographic characteristics of respondents from the surveyed respondents in the business sectors.

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Table 1. Socio-Demographic

Variables	Category	Frequency	Percentage
Sex	Male	155	73.81%
	Female	55	26.19%
Age	below 20	1	0.48%
	21-30	80	38.10%
	31-40	115	54.76%
	above 41	14	6.67%
Marital Status	Single	65	30.95%
	Married	145	69.05%
Education Level	below slc/see	3	1.43%
	slc/see	28	13.33%
	Bachelor	132	62.86%
	Master	41	19.52%
	above master	6	2.86%
Working Experience	below -10	139	66.19%
	10_15	60	28.57%
	16-20	10	4.76%
	ABOVE -21	1	0.48%
Business Types	Small Business	119	56.67%
	Travel Company	4	1.90%
	Hospital/Pharmacy	16	7.62%
	Construction Company	10	4.76%
	Others	61	29.05%
Position	Accountant	148	70.48%
	Manager	27	12.86%
	Staff	15	7.14%
	Others	20	9.52%

General Understanding on Accounting Software

This study revealed that all the respondents had ample understanding about importance of Accounting Software (Reagans et al, 2005). It revealed that 65% of business sector in Kathmandu valley have applied Accounting Software. Several past studies have shown that those business who have applied Accounting Software have garbed bunk of advantages in their operation (Shakya & Shakya, 2020). Likewise, 82% of the respondent have stated that implementation of Accounting Software in organization is unaffordable as their operating cost is high (Rahman et al., 2015). Thus, the government should rethink their policy for making sound IT and Accounting Software friendly environment in country. Similarly, 63% of respondent stated that organization provides ample support in adoption of Accounting Software (Chau, 2010). 90% of the respondent think that implementation of Accounting Software offers numerous benefits.

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Challenges

The study modal response reveals 94% of business in Kathmandu valley have challenges in adoption of Accounting Software (Dhital, 2018). This concludes the fact that majority of the business in the Kathmandu valley has been facing the challenges to adopt accounting software. Furthermore, the result of the study also indicated that complexity and difficult in adoption of Accounting Software (68%) lack of management support (66%), cost of implemental program (66%) lack of infrastructure (57%) etc. were the most eminent challenge, faced in by business sector in adoption of Accounting Software in Kathmandu valley (Devkota et al, 2021). Similarly, the majority of the respondent stated that employees Board of Directors, manager's organization polices and suppliers were the significant entities responsible for adoption of Accounting Software (Rahman et al, 2015).

Managerial Solution

After that last section entails managerial solution for effective execution and implementation of Accounting Software in organization (Berić et al, 2018). Respondents were asked whether the above challenges are manageable or not? The result indicates that majority (96.19%) of respondents thinks they are manageable. This means that every problems have their solution where majority of the respondents in the business sectors thinks the problems are manageable. Similarly, the studies identifies some of the effective strategy for adoption of Accounting Software such as infrastructure (100%), training and development (94%), recruiting skilled employees (86%), supplier support (81%) and management support (62%) have an eminent role to play to the successful adoption of Accounting Software, tanning and development, cost effective has and improved government rules and regulations (Elbahri et al, 2019).

Inferential Analysis

Summary Statistics

In this study total 210 observation were collected from the Kathmandu Valley. The findings of summary statistics revealed that, the skewness ranges from -1.981 to 1.392 which is greater than -2 and less than 2 indicating that it is acceptable (Kallner, 2018) and is negative skewness. Similarly, the kurtosis values range from -0.332 to 7.488, indicating that the distribution is not overly peaked.

Exploratory Factor Analysis

Exploratory factor analysis is a set of approaches used to investigate how underlying constructs influence responses to a variety of measured variables (Beavers et al., 2013). It is examined by using KMO and Bartlett's Test. The obtained KMO value is 0.792 i.e., greater 0.5 which reveals that there is sufficient connection among the components (Gaskin, 2021). On the other hand, for Bartlett's test of sphericity the data is considered significant as the P value is 0.000 which is less than 0.05 which indicates that factor analysis is useful where it shows the data has good fit for this study and further process can be done.

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Common Method Biased

Common method bias is done by using Harmon's single factor test to confirm if the variance is explained by single factor. SPSS have extracted six factors and the cumulative percentage is 23.304% which is less than 50%. So, these six factors explained 23% of the variance. If the total variance for a single factor is under 50%, it suggests that the problem of CMB does not exists and suggest the data are appropriate for further analysis (Fuller et al., 2016).

Measurement Model

For the validation of dataset, there are two condition that must be fulfilled. For the convergent validity, the conditions are AVE>0.5, CR>0.7, CR> AVE and for discriminant validity, the conditions are AVE> MSV, AVE>ASV and ÖAVE> r (correlation) (Hamid et al., 2017). The data meets all of the convergent and discriminant validity criteria (see table 2 and table 3). Thus, this study can conclude that there is not any validity concern. The Cronbach's Alpha is also analysed. The Cronbach's Alpha value for all the construct meets the criteria i.e., greater than 0.7 (Ursachi et al., 2017). Hence, the data taken for this study is reliable and valid.

Table 2. Reliability and validity table

Construct	Indicator	Factor Loading	CRONBACH'S ALPHA	CR	AVE	MSV
Performance Expectancy	PE1	0.790	0.809	0.811	0.519	0.365
	PE2	0.766				
	PE3	0.746				
	PE4	0.719				
Effort Expectancy	EE1	0.778	0.804	0.810	0.518	0.365
	EE2	0.743				
	EE3	0.793				
	EE4	0.707				
Social Influence	SI1	0.826	0.825	0.826	0.544	0.298
	SI2	0.685				
	SI3	0.804				
	SI4	0.763				
Risk	R1	0.794	0.804	0.769	0.527	0.027
	R2	0.782				
	R3	0.823				
	R4	0.754				
Trust	T1	0.886	0.806	0.821	0.610	0.009
	T2	0.887				
	T3	0.767				
Software Adoption Intention	SAI1	0.845	0.801	0.807	0.585	0.076
	SAI2	0.791				
	SAI3	0.863				

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Table 3. Latent construct correction

		SAI	PE	EE	SI	T	R
SAI		**0.765**					
PE		0.160	**0.720**				
EE		0.196	0.604	**0.720**			
SI		0.276	0.546	0.484	**0.737**		
T		-0.030	0.094	0.042	0.096	**0.781**	
R		-0.163	-0.027	-0.070	-0.053	-0.088	**0.726**

Confirmatory Factor Analysis

Confirmatory factor analysis (CFA) aims to establish sets of observed variables that can better define sharing the co-variances features that will better define the co-variance characteristics constructs (Beavers et al., 2013). For a good fit, the obtained value of the indicator should meet the acceptable value (Brown 2008). In the table all the result except NFI, AGFI and RFI meets the acceptable range. Table 4 indicates that this study has good model fit.

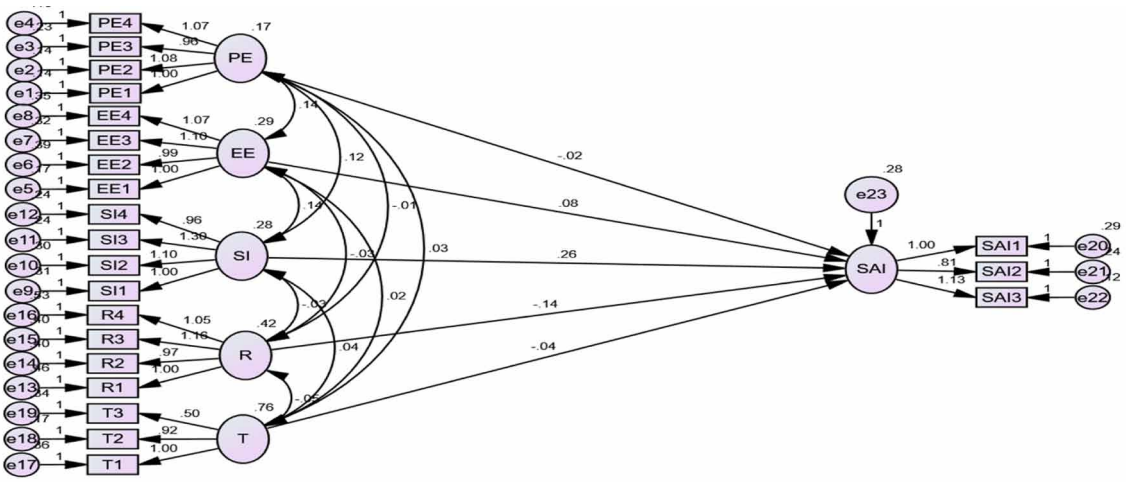
Table 4. Statistics of goodness of fit used in SEM

Name	Results	Acceptable Values	Judgment of Model Fit
Chi- square/df (CMIN/df)	1.311	<5	Good Fit
Root Mean Squared Residual (RMR)	0.032	<0.08	Good Fit
Goodness of Fit Index (GFI)	0.905	>0.8	Good Fit
Normed Fit Index (NFI)	0.867	[3]0.9	Not fit
Adjusted Goodness of Fit Index (AGFI)	0.876	>0.9	Not fit
Relative fit index (RFI)	0.842	>0.9	Not fit
Comparative Fit Index (CFI)	0.964	>0.9	Good Fit
Turker-Lewis Index (TLI)	0.957	>0.9	Good Fit
Incremental Fit Index (IFI)	0.965	>0.9	Good Fit
PCLOSE	0.932	>0.05	Good Fit
Root Mean Square Error of Approximately (RMSEA)	0.039	£ 0.08	Good Fit

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Path Analysis

Figure 2. Combine Confirmatory Factor Analysis Diagram



Various components were addressed by using SEM-used to evaluate regression analysis, variable analysis, and the normalization pattern during the inferential analysis of the research. Figure 2 shows the path analysis on the basis of latent variables vs observable variables, where various components were addressed by using SEM-used to evaluate regression analysis as well as variable analysis.

Table 5. Hypothesis testing

Hypothesis	Estimate	S.E.	C.R.	P	Significant / insignificance	Conclusion
H1: Performance Expectancy Software Adoption Intention	0.037	0.020	1.868	0.062	Insignificance	Rejected
H2: Effort Expectancy Software Adoption Intention	0.060	0.026	2.265	0.023	Significance	Accepted
H3: Social Influence Software Adoption Intention	0.082	0.027	3.065	0.002	Significance	Accepted
H4: Risk Perception Software Adoption Intention	-0.066	0.032	-2.068	0.039	Significance	Accepted
H5: Trust Software Adoption Intention	-0.015	0.040	-0.368	.0713	Insignificance	Rejected

The study investigates the application of UTAUT as a theoretical framework for predicting employee's intention to use Accounting Software and provide suggestions to invest logically in improving in certain areas that are likely to provide a better overall result. From the analysis it is concluded that effort expectancy, social influence and risk perception plays a significant role in predicting employee's intention to use Accounting Software as the P value of hypothesis 2, 3 and 4 are less than 0.05. The remaining other

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hypothesis are rejected concluding that there is no significant relation by performance expectancy and trust on intention to use Accounting Software (see table 5).

DISCUSSION

In this study the level of education of the respondent is remarkable with 63% of respondent of bachelor and 22% of respondent have master above degree. Which indicates the positive aspects for adoption of Accounting Software. A well-educated workforce promotes the skills, knowledge, understanding, values, and action required to create a more sustainable world. It indicates that the highest level of academic qualification amplifies successful execution and implementation of Accounting Software (Nyamwanza, 2014). The finding of this study revealed that 82% of the respondent have states that implementation of Accounting Software in organization is unaffordable as their operating cost increases. Thus, the government should rethink their policy for making sound, IT and Accounting Software friendly environment in country.

The finding of the hypothesis stated that Accounting Software Intension and performance expectancy shows negative and insignificant relationship. Likewise, software Adoption Intension was positively related to employees Effort Expectancy. It can be interpreted that when an employee's perceives the ease in using Accounting Software, so the employees will increasingly intend to use Accounting Software in performing business activities. Software Adoption Intension was positively related to employees Social Influence. This implies that employees of the Nepal feel that social influence is an important factor to use and adoption of Accounting Software. Software Adoption Intension was positively related to Risk. Software Adoption Intension was not positively related to Trust.

The study has identified some of the challenges in adoption of Accounting Software in Kathmandu Valley. From the analysis about challenges in adoption of Accounting Software in the study, the modal response reveals 94% of business in Kathmandu valley have challenges in adoption of Accounting Software. The result of the study indicated that complexity and difficulty in adoption of Accounting Software is 68%, lack of management support is 66%, cost of implementation of program is 66% and lack of infrastructure support is 57% etc. were the most eminent challenges faced by business sectors in adoption of Accounting Software in Kathmandu valley.

Technology plays an integral role in the real world, adopting an optimal approach when designing Accounting Software to meet the project goal. Nepal appears to lag behind. While taking small strides in technical development, through e-commerce, digital wallet, Internet broadband, online enterprise, gaming, entertainment and many more, are going in the same direction to encourage individuals with all the new technology trends. In order to satisfy the software demands of consumers, numerous small, medium and large software companies are developing in Nepal. So, to meet such target promotion strategy should be done by the government. Like different facilities are provided to hydropower industry in that way different Accounting Software should be given more importance. As Nepal is moving towards globalization, many MNCs are operating in Nepal have been doing their business at exceptional level. Today in Nepal there is a need of Accounting Software by the organization. Hence, Accounting Software can play an eminent role in achieving business goal within the country.

This study emphasis on understanding adoption of Accounting Software by the employees in Kathmandu valley. This study has covered few areas in context to Accounting Software but it has several limitations that could serve as an avenue for further studies. First this study was conducted in 210 business sectors

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in Kathmandu valley. Hence the finding of this study cannot be generalized to other business sectors of Nepal due to various business sectors. The further researches should try to cater other business sectors of Nepal too so that it can create clearer picture about Accounting Software in other parts of the country. Furthermore, because of the diverse cultural contexts, the results of this study cannot be applied to other countries; therefore, caution should be exercised when interpreting the findings of this study.

CONCLUSION

This empirical research work has provided useful insights into understanding employee adoption of Accounting Software in the context of a developing economy like Nepal, where business sectors are thriving. Data were gathered from all 210 business sectors, primary data was gathered through interviews using a structured questionnaire, and Structured Equation Model (SEM), were used to scrutinize and analyse the study data in detail. Result revealed that younger people with entrepreneurship mind-set are very reluctant towards adoption of Accounting Software and also have optimistic beliefs and attitude towards Accounting Software. The factors determining adoption of Accounting Software were measured through performance expectancy, effort expectancy, social influence, risk, trust and software adoption intension. It is found that performance expectancy, effort expectancy, social influence and risk influence the Software Adoption intention of employees to use Accounting Software. However, trust does not influence the Software Adoption intention of employees. Respondents also provided some of the suggestions to improve the scope and depth of adoption of Accounting Software. The recommendations provided by respondents are infrastructure (100%), training and development (93.8%), supplier support (80.9%), recruiting skill employees (85.7%), user-friendly software development (72.8%), management support (61.9%), infrastructure and government support (45.2%). Based on the findings suggestions such as advancement of infrastructure and technology, providing training and empowering employees, and flexible government policies and statements are recommended as a recipe by the researcher for the effective implementation of Accounting Software in business sectors. Moreover, the government has to play the key role in implementation of Accounting Software in business sectors by providing subsidy in computerized instrument, reduce the internet cost by increasing speed, reward and motivation to those firms who used such system in their accounting practices. As well government has to develop root or base for using advance technology by applying in education curriculum.

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Chapter 11
Using "Digitalization + Intellectual Property" Management to Realize Cultural Economy:
Case Study of Chinese Museums

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ABSTRACT

This chapter intends to examine the degrees of digitalization with several Chinese museums renowned for their IP creations in reflection of the combination of ancient Chinese culture and modern design thinking and to describe the transformation in Chinese digitalization. Attributing to some inclusive policies, museums are enforced to shift their functions for visitor engagement, which plays a role as a social service with non-profit ambition in improving the tourism economy and social welfare. Our understanding of the enabling and limiting mechanisms paves the way for more research on the paradoxical implications of transformative changes in practical enhancement in the Chinese cultural economy.

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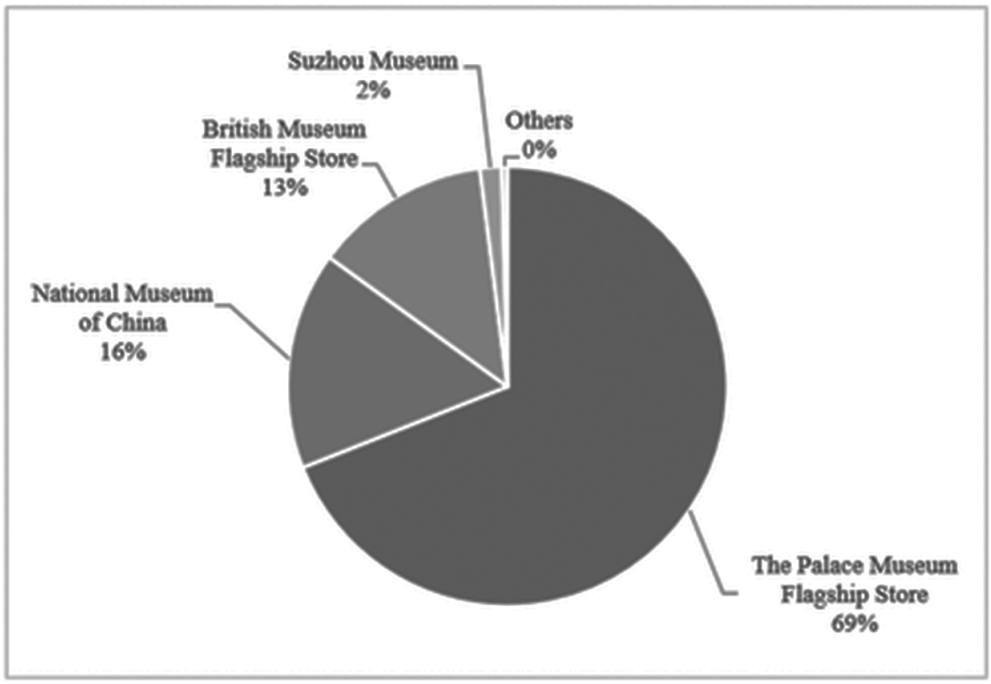
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INTRODUCTION

Digital transformation is known as the use of information, computers, communications, and networking technologies to alter enterprise operations, business, and value creation processes. In this favorable environment, museums are gradually grasping the opportunities of the times to further strengthen their basic public service functions (Vial, 2019).

Spring Festival meets Winter Olympic Games for yearly tourism opportunities and flavour. According to the data center of the Ministry of Culture and Tourism, during the 7-day Spring Festival holiday in 2022, the country's domestic tourism amounted to 251 million people, down 2.0% year-on-year, recovering to 73.9% of the same period of the 2019 spring holiday; the domestic tourism revenue reached 289.198 billion yuan, down 3.9% year-on-year, recovering to 56.3% of the same period of the 2019 spring holiday. No major safety accidents occurred in the national culture and tourism system, and the holiday market was generally safe, stable, and orderly (Ministry of Culture and Tourism of the People's Republic of China, 2022).

Figure 1. Distribution of the top 100 museum cultural and creative products sources of sales in 2021
Source: Tmall (a new B2C comprehensive shopping site developed by Taobao.com.)



As Figure 1 shows, as of 2021, among the 1,861 cultural and creative products from the flagship stores of major museums on the Tmall platform[1], 69% of the top 100 selling cultural and creative products were from the Forbidden City Museum, followed by the National Museum and the British Museum. Among the local museums, only Suzhou Museum made the list, accounting for only 2%. Since the percentage of sales in other local museums is less than 0.1%, it is not reflected in the table.

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Figure 2. Changes in the total number of museums and the number of new museum in China from 2010 to 2020
Source: National Cultural Heritage Administration (2020), http://www.ncha.gov.cn/index.html

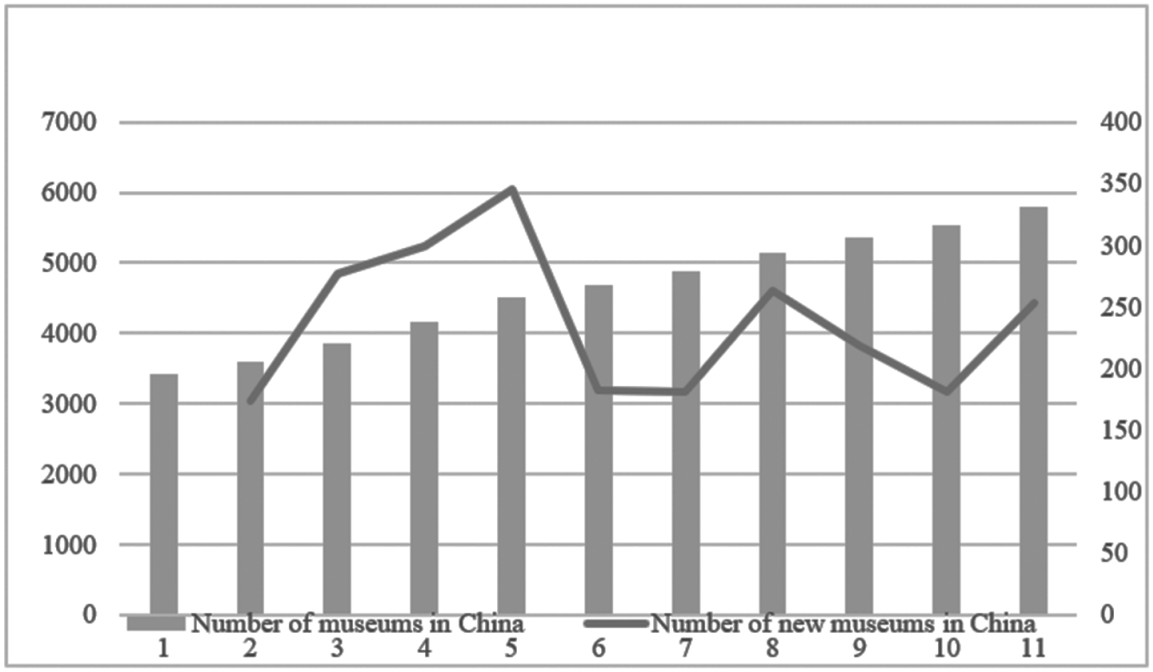


Figure 2 indicates that, in 2010, the number of domestic museums in China was as low as 3415. However, after 10 years, this number increased by 69% to 5788. The number of new museums per year ranges from 181 to 345, with a relatively stable number of new museums added each year. The above evidence is sufficient to show the steady trend of museum construction and development in China, which also lays the foundation for the rapid development of museum culture and creativity in recent years.

Understandably, Chinese planners and scholars are assessing the social, psychological, and environmental impacts of such a rapid growth of tourism (Shan, 2014). A museum is essentially a cultural unit of public interest, with the main functions of collection, education, display, record, etc.. It is a building that exists to meet the diverse spiritual and cultural needs of the people (Connell et al., 2021) and needs to generate appropriate economic value to maintain the continuation and development of the building (Lin, 2007). Museums around the world are diverse with many different collections of artifacts and cultural specimens, the embodiment of the iconic, valuable and intangible cultural heritage of different places or regions.

The development of modern museums' cultural and creative products is urgent (Song et al., 2021). Based on the combination of economic interests and cultural needs, the actual needs of the consumer group for the promotion and publicity of resources are an important addition to the cultural communication function of museums and thus need to be incorporated into the development process in order to achieve both social and economic benefits.

This paper analyzes the process of integration of ancient Chinese culture and current technology from multiple dimensions, using the digital transformation and the process of cultural and creative develop-

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ment of contemporary Chinese museums to propose constructive ideas about the realization of cultural and tourism economic planning and management.

LITERATURE REVIEW: DIGITAL TRANSFORMATION OF MUSEUMS

The President of the People's Republic of China, Xi Jinping, in his China Dream of the 'new normal' and his *Mass Line campaign* has sought to use the soft power of the state to create an official story of China's restoration of greatness – a policy that infiltrates tourism, interpretations of culture past and present, and what can be shown in museums (Dai et al., 2017). Reflecting Chinese cultural confidence, not only in the economic revival commenced by Deng Xiaoping but also in a rediscovery of its past is a recovery necessitated by the hubris of the Maoist years. Indeed, even Mao has been brought back to service[2] the contemporary Chinese tourism industry in the form of 'Red Tourism' (Chen & Ryan, 2020).

Since there has been a considerable increase in multimedia technology consumption by customers, we can perceive an increased need for developing online exhibitions and enhance museums' educational functions. China Digital Science and Technology Museum (CDSTM) is showing increased efforts in this field, aiming to provide solutions to issues of unbalanced museum distribution, exhibition space limitation in China, and seeking more ways to offer diverse and multimedia-rich exhibitions (Dong et al., 2011). The virtual museum employs the newest development of technology to portray and discuss the major impacts of science and technology developments on people's lives in order to expand the public's perspective.

Guided by this philosophy, museums have mainly concentrated on the design, organization, and presentation of museum exhibits. Nonetheless, museums disseminate cognitive and affective knowledge to attract both locals and out-of-town visitors through embodied interactions and responses. The research (Jin et al., 2020) examined visitors' satisfaction with visiting museums and found that learning is not an all-encompassing motive. The theme of the 2009 International Museum Day was 'Museum and Tourism', which makes explicit contemporary museums' shift in focus from the collection and preservation of artifacts to the creation of visitor experiences (Zhao, 2012).

During the "13th Five-Year Plan" period (2015–2019), the added-value of China's cultural industry grew from RMB 2.7 trillion to over RMB 4.4 trillion, with an average annual growth rate of nearly 13% and an increase from 3.95% to 4.5% of GDP over the same period. Since 2017, the Chinese government is moving towards its goal of making the cultural industry a focus pillar. Principally, China emphasizes the duality of culture in political discourse, that "culture" has both aesthetic and ideological value. In the 1980s, a cultural system reform started and the new perspectives that culture was an economic entity and an industry category emerged later. As China entered the World Trade Organization in 2001, it continued fostering the cultural industry and started articulating cultural exportation, but it was also more alert to protect cultural sovereignty (Guo & Liu, 2021).

Chinese cultural policies in the 2010s had two targets: (a) to adapt to the socialist market economy and (b) to demonstrate the value of culture in socio-economic development (Ch'ng et al., 2019). In light of China's fledgling digital cultural industry, both the government and the enterprises have kept exploring its development models; thus, there were opportunities of "opening the policy windows". In the 2010s, owing to "Triple Play" and by closely affiliating with mobile Internet breakthroughs, not only the Chinese cultural industry became vibrant, but also a range of new sectors such as computer animation, e-literature, and digital audio-visuals arose. In order to better promote the sustainable development of

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cultural economy, the authors believe that the application of intellectual property (IP) rights in China will help stimulate the interests of all stakeholders in the digitization process of Chinese museums.

THEORETICAL BACKGROUND

In 2007, World Intellectual Property Organization (WIPO) claimed that the Guide, Managing Intellectual Property for Museums, copyrighted by Mrs. Rina Pantalony, could be regarded as origin for IPs for museums. Then on 20th March 2015, the State Council of the People's Republic of China promulgated the legislation Regulations on Museums, formally marked as the first paper legislation on a national level in China, to facilitate the development of the museum undertakings, give play to the role of museums, meeting citizens' needs for intellectual and cultural lives, and raising citizens' ethical and moral standards as well as their scientific and cultural standards. Since then, domestic museums are encouraged to create and promote their IP (Xiao et al., 2019).

All cultural resources are held by the state under communist China, and cultural creation and dissemination were funded by the state and carried out through state-controlled organizations (Shan, 2014). Cultural policy is an important area of policy concern in recent years, especially in China. Despite the complex relationship between cultures in China's economy and society, the government's cultural policy, which can be expressed in simple language, has two main objectives. The first recognizes the fundamental role of culture in the Chinese language and the importance of Chinese cultural and artistic traditions in Chinese identity. Public expenditure in this area includes measures such as preservation and conservation of cultural heritage, support for museums and galleries, and provision of community culture (Zhang et al., 2022).

During the latter years of the twentieth century, cultural policy in China evolved rapidly, reflecting the significant transformations in economic, political, and social life following the vigorous modernization programs introduced by Deng Xiaoping in the late 1970s. An important shift in Chinese cultural policy occurred at the beginning of the present century, when the concept of the creative industries was taken on board, originally in Shanghai and then in the central government in Beijing (Li & Kovacs, 2021).

For instance, the tech-backed Beijing 2022 Winter Olympic Games included several Chinese IT firms. Clean energy, artificial intelligence (AI), and 5G technologies have been widely implemented, from training preparations to venue building. This smart augmented reality (AR) navigation application can sustain an immersive virtual-real fusion effect with accurate placement and no delay in any location within a 300,000-square-meter area thanks to several technical advancements. Complex settings, such as buildings, ice, and snow, will not affect it. According to sohu.com, the program does not require a standalone APP and can be readily utilized with only a web browser (Global Times, 2022).

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RESEARCH METHODOLOGY

Case Description

Transformation with Digitalization

Digitalization is the generic term for the Digital Transformation of society and the economy. For our paper, the key is that people are enabled to cross the geographic and cultural borders; it helps preserve and exhibit the cultural relics. This is important considering that most Chinese paper cultural relics are hard to preserve against gradual oxidation. By virtue of holographic projection, virtual reality (VR), AR and digital sand tables, exhibitors can better simulate the cultural relics or the scenes without any form of touch to the authentic relics; Also, the collocation of hard-ware resources in multimedia caters to the specific customers: smart technologies attract the adolescent —— the juniors. Both VR and AR have been launched in a considerable number of museums and cultural heritage sites (Ferwati & El Menshawy, 2021) and have much scope for future studies on application in tourism. They can enhance tourists' experience and complement the limitations of real sites. To respect the rights of the communities over their cultural values the participation of their representatives is needed where the cultural values are still alive (some of the cultural values are the object of ownership, others to copyright or related rights). Along with the advantages of digitization, there is a potential danger of abuse with the cultural and economic characteristics of cultural values. Therefore, a challenge, facing the system for the digitization of cultural heritage, is also the establishment of mechanisms to restrict access to it (Borissova, 2018).

Currently, synergies and the utilization of AI enrich museum visits digitally and are incorporated in our on-demand visiting system, undoubtedly composing a robust framework for applications related to cultural interaction (Ioannakis et al., 2020). The benefits of digitalization in cultural preservation are their durability and presenting scholars with more accurate, precise, and economical documentation that is subject to far more analytical measurement. Rather than documenting an idealized symmetrical form as generated by traditional hand-drawing techniques, the actual existing form of the artifact can be documented using digital means (Kwan & Kwan, 2017).

AR is any device which augment virtual objects onto the real world using QR code, images, or spaces (e.g., HoloLens) VR are displays which completely immerse a user into a virtual world (e.g., headsets, CAVE), this includes 360° videos (Asadzadeh et al., 2021).

Compared to the traditional cultural industries that were often faced with institutional obstacles and hindered by ideological factors, the digital ones could perform with more freedom[3]. A considerable corpus of literature explores the advantages of VR in museums in terms of alternative content delivery, the customization of museum experiences, and visitor participation. In most cases, VR was introduced in the participating museums for the first time in the last eight or nine years, with the vast majority being introduced after 2015. VR is used by most participants (nine museums) more sporadically in the context of temporary exhibitions, although six participating museums incorporated this technology permanently. VR has been actively adopted in cultural tourism because some of its characteristics help to achieve the tourism industry's goal of providing tourists with unique and enhanced experiences (Lee et al., 2020). Digital innovation technologies such as AR come on stage right now. AR is a visualization technology, able to introduce more information into the real world, instead of replacing it. This may be obtained by superimposing visual, auditory, tactile, or even olfactory materials in real-time on physical objects presented via devices.

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In art museums, this is usually a place depicted in a painting or even the actual studio in which an artist worked to get a sense of his/her ordinary life. VR was also used to immerse the visitor in history and places that cannot be currently experienced, as for example in Emperor Qin's terracotta warriors Museum. And most participating museums have an overall digital strategy, either in the form of a roadmap or in the form of particular goals for introducing emerging technologies. Despite the existence of such strategies, they are usually quite broad and cover many aspects of digital experiences, from social media to virtual tours to VR, and usually do not include specific guidelines on VR (De Wever & Guiraud, 2018).

Finally, VR provides increased accessibility for online visitors who want to have museum experiences at home and allows a museum to reach thousands of people, by offering "an immediate translation of their building and the collection to the digital world. Exhibition flow issues were also raised as a challenge by three participants, who reported that they needed extra staff resources to manage the queues formed. Although some solved this through a booking system with time slots, the most difficult problem to the exhibition flow was created when the VR malfunctioned and "took down" the entire experience (Elkadi et al., 2021). Especially if the VR is a central component of the exhibition and interpretation, this can ruin the visitor experience. Issues relating to cost, usability, sociality etc. need to be incorporated in the design process VR design should be based on the actual needs of museums and their audiences, taking into account all their concerns to provide not necessarily the most innovative, but the most meaningful, truly engaging, and memorable museum experience (Shehade & Stylianou-Lambert, 2020).

Additionally, since the Internet users are neither tied into the Chinese Communist Party's propaganda system nor motivated by the commercial incentives that govern cultural industry practitioners, their activities do not necessarily lend themselves to the governance mechanisms that apply to business entities.

Transformation with IP

In February 2011, the Ministry of Culture and Ministry of Finance in China issued the policy, which clearly defined all of the National Arts Museum, Public Library, and cultural centers would be open free of charge before the end of 2011 (De Backer et al., 2014). The application of virtual reality technology applications allows people to browse virtual museums from the comfort of their homes. People can not only achieve an immersive feeling, but can also interact with the virtual museum.

The traditional point of view of museums, no matter where they are located, has been that IP, in particular copyright, has inhibited their ability to carry out their mission and mandate. IP, in particular copyright, is highly valuable to the development of a forward-thinking society. Modern history has shown that culture, and in particular the enrichment of a society's patrimony, is dependent upon adequate IP protection provided to literary and artistic works. A society fosters and nurtures the creative process by providing the impetus to create new artistic and literary works through IP protection (World Intellectual Property Organization, 2022).

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Figure 3. The consequences of no appropriate IP protection
Source: The Association of Southeast Asian Nations (ASEAN) Secretariat (2019), https://www.aseanip.org/Portals/0/PDF/FINAL-HANDBOOKONIPCOMMERCIALISATION.pdf

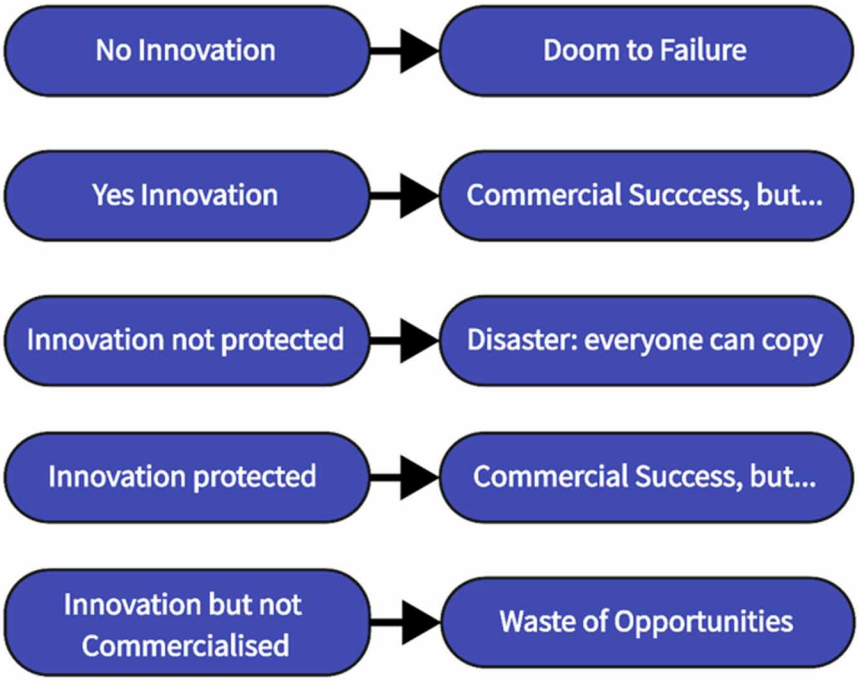
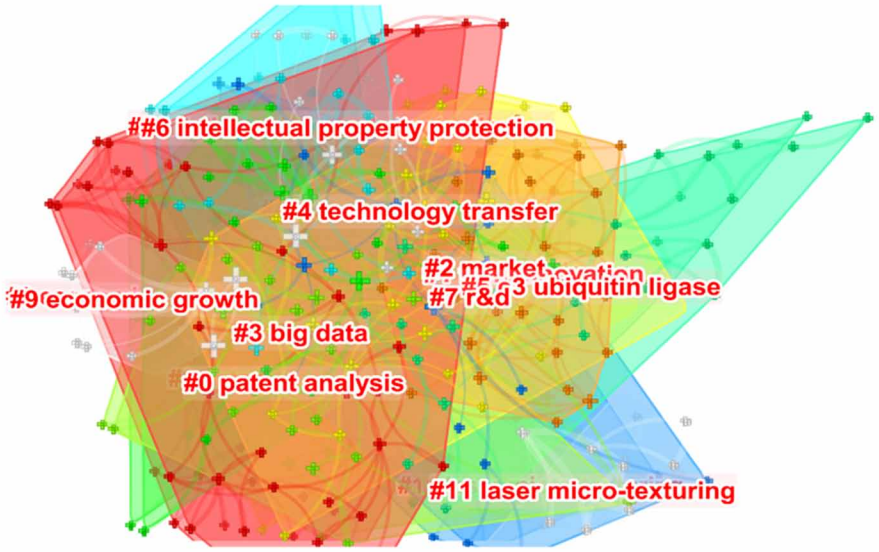


Figure 3 suggests a comparison of the difference between whether or not innovation and IP protection is performed. It points out that museum derivatives[4] are the symbols of museum mobility (Zhang et al., 2020). Only by strengthening the design ability of museum derivatives and making them possess cultural, educational, and product characteristics can they provide better cultural services for the public. Museum derivative production has developed rapidly, and their quantity and sales amount is growing rapidly. However, the design quality of derivatives is relatively low (Lei Wei, the associate editor) and the products usually suffer from a lack of creativity, are highly homogeneous, and outdated. Some museums have no creative derivatives themselves and only fill in the blank with replicas of cultural relics and tourist souvenirs. This cannot meet the needs of the artistic communication of the museum and the consumer's aesthetic needs.

Therefore, the artistic and literary creative process, if harnessed together with scientific knowledge, will lead to a veritable explosion in the invention, innovation, and productivity within society. Once the functioning of digital device in museums is fully established, the public can experience and enjoy the scenario of on-demand digital content enrichment of museum-visit experiences.

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Figure 4. The clustering analysis of influential factors on Chinese cultural economy (analyzed by CiteSpace)
Source: Web of Science



Employing the keywords 'China "cultural economy" "tourism development", using CiteSpace cluster analysis, we get the results shown in Figure 4. It can be seen that ' patent analysis', 'IP protection', 'technology transfer', and other desired keywords have significant influence and rank centrality. This indicates that China's cultural economy and tourism are becoming increasingly important. To comprehensively examine the research results of museum creativity, this chapter counted the core journal literature output published in the past ten years. Among them, the core literature on "cultural and creative products" appeared in 2011, while the core literature on "museum creativity" beginning to appear after 2015. The number of articles in the field of museum culture and creativity research can reflect the research status of domestic museum culture and creativity industry in a specific period.

Digitization and Intellectual Property

Digitization is a complex technological and creative process, creating a multitude of various independent objects of intellectual property, such as software, databases, photographs, images, etc. (Pavlidis et al., 2007). Digitization in the intellectual property system is the "medium", forming a new environment for the creation and dissemination of the results of creativity, which defines it as an important economic factor for the development of creative economy rights (Neves et al., 2021). Intellectual property is also present in the relationships between experts in research expeditions, in cultural organizations with relation to materials and documents, obtained as a result of their research and their distribution for commercial or scientific purposes (Borissova, 2018).

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Figure 5. Stages of achieving commercialized IP
Source: WIPO, https://www.wipo.int/edocs/mdocs/africa/en/wipo_inn_dak_15/wipo_inn_dak_15_p4.pdf

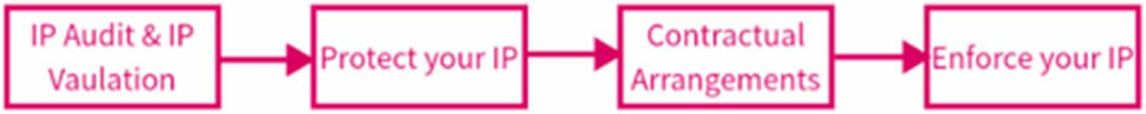


Figure 5 represents the whole process of achieving commercialized IP. The process of IP protection's first stage is to conduct an IP audit and valuation, after which you should guarantee that your intellectual property rights (IPRs) are properly secured (at home and abroad). The next step is to get into the appropriate form of contract that will assist you in effectively commercializing your IPRs. Finally, you must enforce your IPRs.

Added Value of Digitalizing National Museum of China from Stakeholders' Perspectives

For Regulators

Admittedly, the accumulation of multifaceted knowledge and the development of multiple approaches and skills is essential. Museum curators must also function as historians, scholars, art scholars, and art critics. They must be familiar with the laws of museum operation of the museum, but also have a deep enough understanding and study of cultural relics (Qu & Mao, 2011).

A combination of factors, such as globalization, wider socio-political conditions, technological development, networking, new forms of economic activity, multi-cultural environment, as well as intense rhythms forms a new framework in which cultural products and society are in a perpetual process of reformation and shaping, while the physical and digital environments are integrated through networks, technologies, and data. There has also been an increasing interest in providing programs to improve health and well-being, and arts and wellness are more vital than ever during COVID-19. Not only did the crisis prompt museums to adopt and expand practices by creating digital content and programs to keep in touch with the public, but these digital initiatives also helped mitigate the negative health effects of COVID-19 on people (such as isolation and distress) by creating spaces that encourage social interaction, engagement, stimulation, and respite care. As a result, these digital materials can be a valuable resource for improving one's quality of life to maintain or improve one's health. Furthermore, it raises the possibility of museums playing a part in the health care landscape by delivering broader care practices through digital outreach (Kamariotou et al., 2021).

Due to stay-at-home orders and obligatory closures, the COVID-19 epidemic has put many museums in a tough situation, and museums in Singapore are no exception. Despite the pandemic's abrupt halt to operations, the unanticipated interruption has also given the local museum industry a chance to study new ways of audience involvement that might assist to alleviate the negative health effects of COVID-19 on individuals, such as isolation and distress (Tan & Tan, 2021).

Urban heritage anchors the identity and culture of cities and is a key element in the development of a sense of place. The type of heritage will also influence the level of contestation. Contested heritage is often associated with tragic historical events and may evoke negative sentiment along a spectrum ranging

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from colonization to segregation and religious divide to sites associated with war, death, and atrocities. Urban heritage becomes expendable and is likely to fall victim to the imperatives of economic development. Where heritage is retained, its reuse to suit tourism- or gentrification-based adaptations can be contested. For example, in Hong Kong, the conflict between economic viability and heritage value was evident in the revitalization of traditional shop houses. Even the reuse or rebranding of urban heritage as a means of adapting to contemporary needs can be viewed as compromising heritage authenticity (Chen & Mele, 2017). While interdependence between tourism and heritage in the form of uniqueness, authenticity, and diversity can transform urban spaces into pleasant places to live and work, both the effective definition of property rights and the protection of property rights by legal procedures are inseparable from the role of the government. Strengthening intellectual property protection is the most important content of perfecting the property rights protection system, and also the biggest incentive to improve China's economic competitiveness.

For Managers

Artistic authority, defined as the museums' promotion of a wealth of unique artistic products, would help the managers attract more visitors, gain more social attention and motivation to promote more creative ideas and IP from their artifacts, fostering a positive circulation (Li, 2018). For example, the Beijing History Museum was developed so successfully because the designers tapped into the value behind the artifacts in it, and exhibited the precious cultural memories well to visitors. The economic value in itself of the museum is not enough. Museums can license the developed cultural and creative products to the relevant sellers, labels their products or the museum's famous paintings or patterns, which can help expand sales channels and increase the economic recovery to support the museum's daily maintenance and maintenance.

Managers are concerned with social alienation as well as how to ensure economic survival and give humanized services (Li et al., 2021). Cultural institutions need to create a sustainable future and make efforts to ensure cultural heritage information is digitally available for general accessibility. This process of digitalization has a high cost for museum managers and adds the responsibility to safeguard their essential resources and collections. They must also make sure that museums remain important and valuable to future generations by enabling audience participation and enhancing the audience experience. There aren't only technical issues, but also content and communication problems if we consider that such digital heritage applications have to build an experience around visitors, involving them and making them understand stories that sometimes are very complex (Kamariotou et al., 2021).

Specifically, the sector of virtual museums faces a disconnection between the research, that develops tools with little interest in their wide application, and the industry. In this digital era, real/virtual relationship is a primary and demanding question for the future of museums. Unfortunately, digital strategies for museums is not a priority for museum strategists yet. Digital technology and the Internet are reshaping the relationship that an exhibit has with man and society. Exponential technological advances offer ever-faster Internet speeds and availability, increasingly connecting both the digital and physical worlds through a set of interconnected devices, including mobile phones, and offer new possibilities for the preservation, archiving, promotion, utilization, and reuse of our cultural heritage (Y. Liu et al., 2022).

In exhibition communication, understanding factors that motivate visitors is essential and based on the interaction between the museum and its users. This results in museums having rich and multifaceted settings and free-choice learning environments in both the physical and virtual displays and visitor

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motivation determines their actions and communication. In the exhibition, communication knowing the visitors' behavior is also an essential aspect as the behavior of the visitors will influence what they will see, areas of interest and focus, and finally what they stand to learn and experience (Daniela, 2020).

Figure 6. The techniques for the digital museum experience
Source: (Kamariotou et al., 2021)

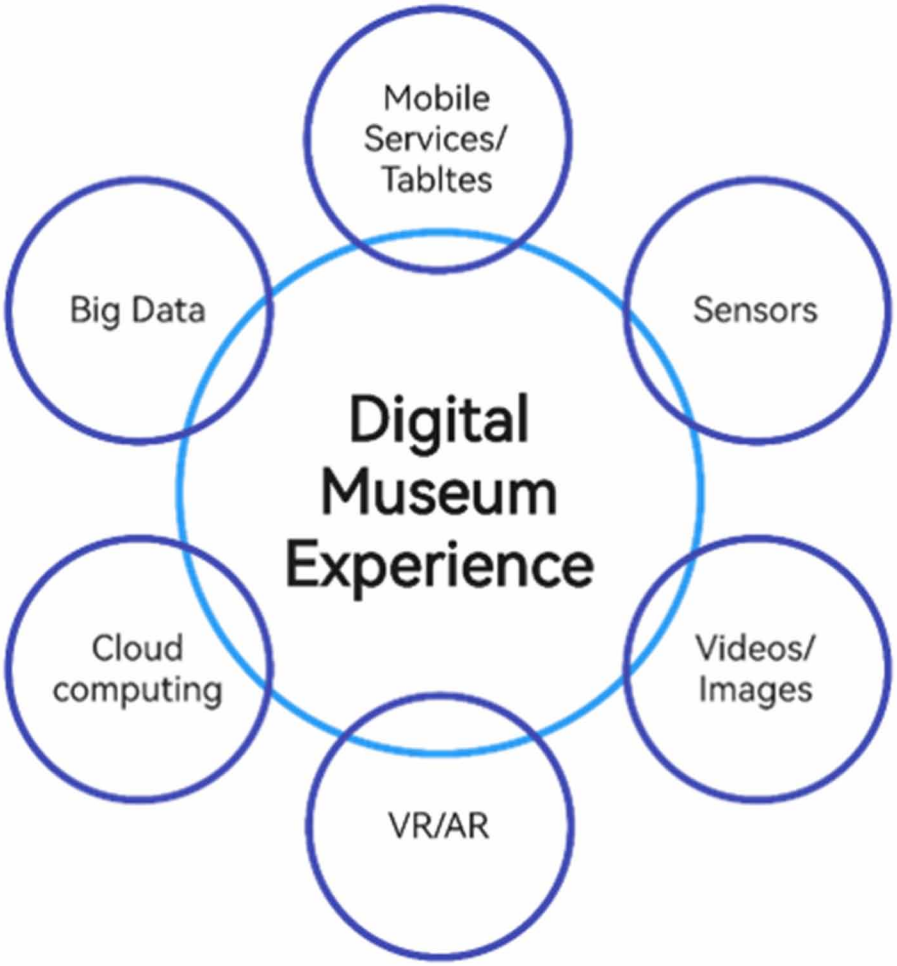


Figure 6 indicates the diverse methods of presentation employed in virtual exhibitions. In the beginning, motionless exhibition methods making use of text or images, similar to digitized collections of books were the trend. However, lately, more effective, convincing, and communicative exhibition methods have risen through the combination of diverse media and communication technologies. A huge difference in exhibition methods is observable in regards to visualization and user interactivity, including high-resolution images, video and hypermedia presentations, Web3D, VR, AR, virtual exhibitions, immersive worlds, sensors that are used to collect data from visitors, educational applications and wearables that are used to improve or create new experiences during the virtual tour (Kamariotou et al., 2021).

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Furthermore, heritage exhibitions, speedily shifting from an old vision, offering visitors with unchanging information made up of a large sum of "cultural signs," to new customized services that satisfy the visitors' tastes by taking into account their cultural desires and likings collectively with information concerning their present context.

An important digital priority is the overall management of the user's experience about cultural content through advanced services. This experience should not be defined in terms of its core axes by quality standards, but in terms of how it will be presented to the public. A mixed model can be followed: the cultural organization that owns the content can set quality criteria and maintain control over the distribution of the content, but the regulated market should offer the channels of distribution of the content to the public. This is seen not only with services like Google Arts & Culture, social networking platforms but also through other platforms for creating digital stories or games. They do not just keep the overall level of quality, but also have the freedom to create applications and the overall environment which is optimal for the user (Damala et al., 2019).

Another factor is information. Virtual museum users have good knowledge of information and are therefore not pleased with restricted access to data in a museum's collection. Social media as a medium should not be only used for publicizing exhibitions and events, but also should be used to enlighten the population about the histories, cultures, and transformation. Currently, almost all activities are carried out online with learning also included. Closing the gap between the practices of both heritage experts and their viewers as well as the concept remains not just a practical likelihood, but is paramount to establishing users' involvement and the respective value of their participation to their experience of heritage. Future researchers might build on the findings of this study by performing qualitative or quantitative studies to assess how users interact with digital exhibits.

For Customers

Instead of experiencing the traditional way of 'being taught', visitors will be able to experience the museums' contents themselves thanks to the power of technology. Social media and online review sites support information search, decision-making, and knowledge exchange for tourists and represent an opportunity for companies in the tourism industry to learn more about needs and find new ways to meet travelers' expectations. Online travel forums are the ideal space for tourists to find answers to specific questions and link to resources to help them make the right decisions as they plan their travels. Reviewers often share advice on practical matters, motivated by a desire for community empowerment, social support, and joint affirmation (Ogie et al., 2022).

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Figure 7. The museum brand importance has positive feedback from customers
Source: (Fronzetti Colladon et al., 2020)

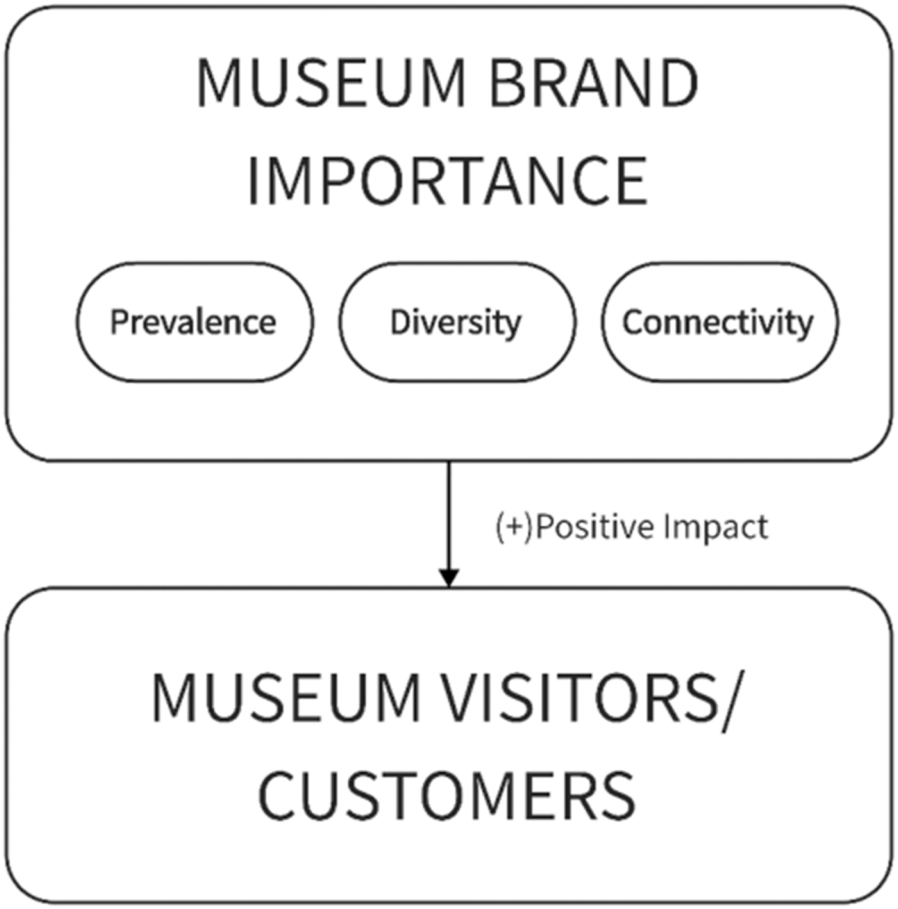


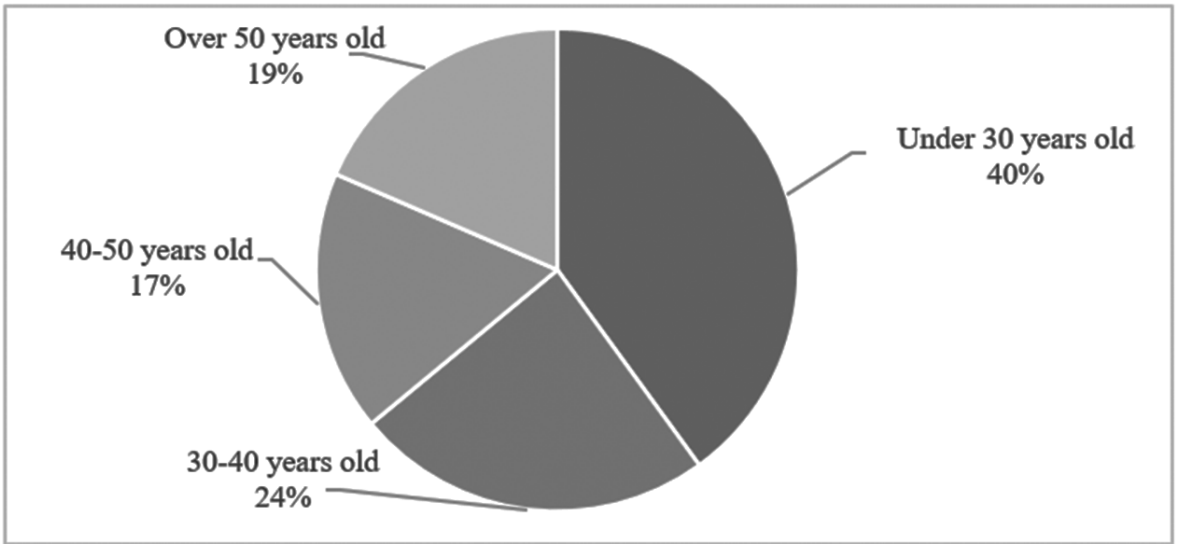
Figure 7 demonstrates the relationship between the importance of branding and user feedback. Customer engagement (CE) is a marketing term that arose around the turn of the century. Despite the growing interest in CE among marketing academics and professionals, no thorough study of CE's past, present, and future tendencies has been published yet (Lim et al., 2022).

To increase museum visitors over time, it is important to increase the online presence via volume of online posting and rich user-generated content around the brand. Tourists might be influenced by the awareness effect generated by online recommendations and the presence of brand names (Khatibi et al., 2020). To increase museum visitors over time, it is important to increase the volume of online posting, rather than controlling for the positivity or negativity of the posts. The design of marketing synergies among institutions has the potential to increase the quality and depth of content offered to potential visitors, which our study shows to be associated with an increased chance of museum visits. Lastly, while it is important to monitor the sentiment of online users towards a brand, our results suggest that museum marketing managers should be less concerned about the positive or negative language used by tourists, and be more interested in improving the quality of the content provided. Future studies should explore the effects of other online user experience factors that might affect brand perception and economic outcome,

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including the official star-rating system, which is a key variable through which tourism destinations – such as museums, hotels, and restaurants – can differentiate their offering (Fronzetti Colladon et al., 2020).

Figure 8. Age of Chinese Museum Culture and Creativity Consumers in 2021 Distribution
Source: National Cultural Heritage Administration (2020), http://www.ncha.gov.cn/index.html



As shown in the figure 8, regarding the distribution of different age groups for museum technology-related cultural and creative products, consumers under the age of 30 account for 40% of the total number of consumers. The number of consumers aged 30-40 is slightly higher than the number of people aged 40-50 and 50+ by a few percentage points, but both are lower than the percentage of consumers aged 30, which also indicates that young people and teenagers, as the main customers of museum products, are somewhat more receptive to the results of digital transformation of museums. In terms of the current situation of the museum cultural and creative market, the branding strategy for customers is done relatively successfully in China. However, there is still room for improvement in the use of digital technologies such as VR and AR technologies.

In general, there is a lack of adequate research on the impact of VR on different levels, some of which are often neglected: From the visitor experience to museological approaches to organizational issues. The insights of museum professionals presented here indicate that there are many issues we tend to forget when exploring the potential of these technologies, which are nevertheless extremely important for museum professionals and the museum sector.

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CASE ANALYSIS

The National Museum

Authorization

The National Museum of China, is the foremost historical and cultural institution to collect representative evidence of Chinese culture, preserving national collective memory and cultural artifacts on behalf of the country, reflecting the fine traditional Chinese culture, revolutionary culture, and advanced socialist culture. With a collection of more than 1.4 million pieces, the Museum fully demonstrates, and bears witness to 5,000-years of Chinese civilization. At present, the museum has cooperated with more than 100 well-known brands at home and abroad and nearly 400 cultural relic IP resources, and more than 500 authorized products have been sold on the market, covering people's clothing, food, housing, transportation, and other aspects, reaching tens of millions of consumers. Cooperations include KFC, Loreal, Lily, etc.

In the context of the integration of culture and tourism, the creative team of the National Museum of China has made great efforts to develop creative products, innovate development models and expand marketing channels relying on the collective resources of the museum. Up to now, the museum has developed 5,000 creative products, covering 12 categories of creative home, office supplies, stationery, clothing accessories, postal products, toys, electronic products, business gifts, etc., which can meet the needs of people at different consumption levels.

Museums are palaces for sheltering and inheriting human civilization, connecting the past, present, and future. At this special time when museums worldwide are jointly overcoming difficulties, the National Museum of China has initiated the project Treasure Hunt Relay: Global Museum Director's Choice to spread the idea of building a community with a shared future for mankind, through dialogue, joint efforts, and win-win cooperation. The National Museum of China has invited directors from sixteen museums across five continents to introduce the history of their institutions and selected objects from their collections. This project will present iconic cultural treasures for a global audience in a relay format, sharing the essence of human civilization through the Web (National Museum of China, 2020).

In January 2016, the National Museum of China (Beijing) Cultural Industry Development Co., Ltd. started to explore the deep integration of museum "collection IP + Internet", and on January 28, 2016, the "National Museum of China Flagship Store" was listed in "Tmall Mall" as the starting point. "On the one hand, the National Museum of China cooperated with many high-quality social forces to explore the potential of museum IP resources and creative product design development, and to open up the whole industrial channel from cultural relics IP to the original design, investment, and production, online sales, forming a seamless connection between cultural and industrial resources; On the other hand, the museum is using the unique collection of cultural relics, resources and academic support to cooperate with many head brands in the industry for licensing, empowering the brand, enhancing the cultural added value of the brand while providing new ideas for the ancient cultural heritage to enter the life of the public. The two-pronged approach of product development and brand licensing has opened up a new model of cooperation and development for the museum's cultural and creative industries.

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Figure 9. Purchasing Process & Art Authorization
Source: (Konev et al., 2019)

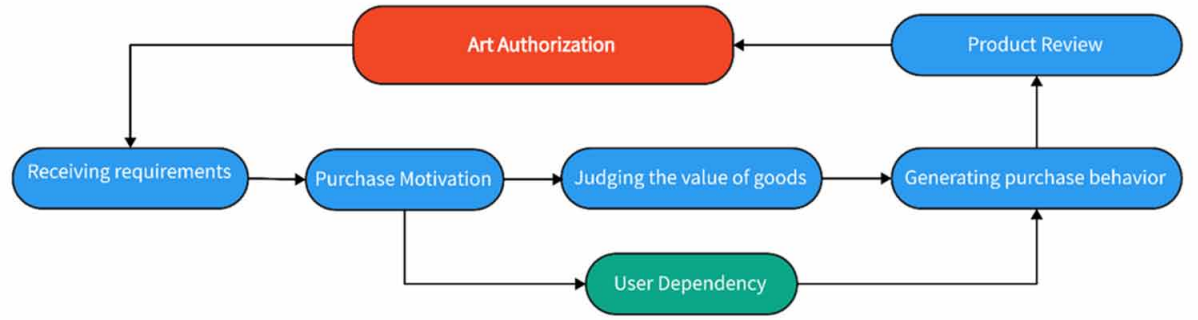


Figure 9 illustrates the Purchasing Process and Art Authorization process. The National Museum of China (Beijing) Food and Culture Center provides visitors to the museum with simple meals, coffee, tea, snacks, and other visitor services, to make every visitor to the museum not only wander through the colorful exhibitions, but also enjoy a variety of personal services within the museum, improving the satisfaction of the visitor experience, and thus enhancing the reputation of the National Museum of China.

With the country's strong support for the cultural and creative industry, the center is also constantly pursuing innovation, combining independent research and development with IP licensing business, integrating the elements of the National Museum of China's cultural relics into the staple, so that visitors can taste the unique cultural diet of the National Museum while visiting, and better promote the development of the cultural and creative industry while serving the audience.

Cultural Policies

The National Museum of China website strictly abides by the Copyright Law of the People's Republic of China, the Regulations on the Protection of the Right to Information Network Dissemination and related laws, regulations, and policies, and actively uses advanced technology for protection.

The National Museum of China website, including but not limited to graphics, audio, video, website layout, web design, and other content, unless otherwise specified, owns the copyright, any unit or individual without prior written permission, are not allowed to use the above content for any commercial purposes or illegal purposes and infringement of our copyright or even affect our museum. The museum reserves the right to pursue legal responsibility for any unauthorized use for commercial or illegal purposes. If information is needed to be shared, the relevant departments of the museum must be contacted and notified in advance (National Museum of China, 2019).

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Figure 10. The existing achievements in the cultural creation of the National Museum of China
Source: Guobo (Beijing) Cultural Industry Development Center https://kns.cnki.net/kcms/detail/detail.aspx?dbcode=CJFD&dbname=CJFDLAST2021&filename=MSGC202102006&uniplatform=NZKPT&v=Cn33-URu6H3Pp6m8MD4XopyYtZM7fcZvFMqn_CK9rrZtL3NSqQfKycLwoD_spjvm

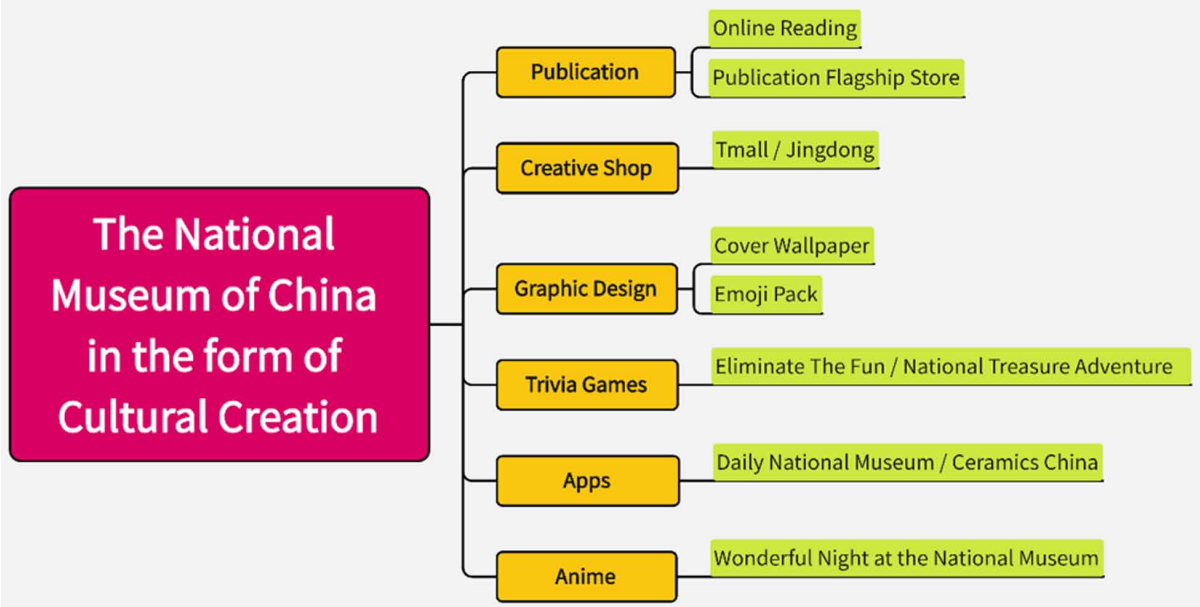
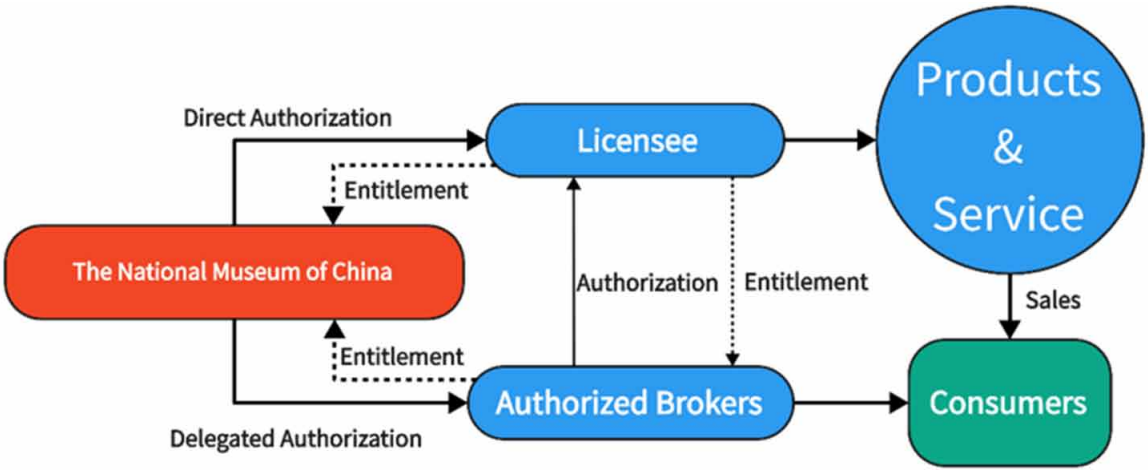


Figure 10 displays the existing achievements in the cultural creation of the National Museum of China. The National Museum exhibition system includes basic displays, thematic exhibitions, and temporary exhibitions. The basic exhibition includes "Ancient China", "The Road to Revival" and "The Road to Revival-New Era" based on the collection, including "Ancient Chinese Coins", "Ancient Chinese Jade Art" and "Ancient Chinese Porcelain Art" and other exhibitions.

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Integrated Licensing

Figure 11. The process of Integrated Licensing
Source: (Mottner & Johnson, 2000)



Integrated licensing, as Figure 11 indicates above, is a combination of direct and delegated licensing models. Depending on the actual needs of the museum, the museum can directly license some of the authorized objects to the licensee, and at the same time, it can also delegate the authorization broker to license other objects to the licensee on behalf of the museum. The licensee will return the royalties directly to the museum, and the licensing broker will return the corresponding royalties to the museum as agreed (Song et al., 2021).

Palace Museum

The Palace Museum, which was inaugurated in 1925, is housed in the imperial palaces of the Ming (1368-1644) and Qing (1644-1911) dynasties. The spectacular architectural complex, also known as the Forbidden City, and the imperial collections' extensive holdings of paintings, calligraphy, pottery, and antiquities make it one of China's and the world's most prominent museums. The old imperial home was identified as one of China's most important cultural heritage monuments by the State Council in 1961, and it was inscribed as a UNESCO World Heritage site in 1987.

Cultural and Creative Product Development

Admittedly, the Forbidden City cultural and creative products themselves have great advantages, laying a good foundation for their successful development. The conditions of the products themselves provide a wealth of opportunities for R&D team construction, design, overall creative concepts, high product pricing, and a good practicality or cost performance. As a first step, the Palace Museum has set up an experienced creative R&D team to provide strong support for the development of cultural and creative products.

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The entire cultural and creative team of the Palace is mainly divided into a product research, a development department and a product design department. In the process of generating the products first of all the research and development department and experts and scholars exchange and study in order to grasp the cultural connotation of the Palace's cultural relics. In the next step, the design department combines the historical atmosphere of the cultural relics themselves with modern expression to create cultural products that are uniquely attractive and rich in cultural connotation. In addition, the Palace Museum has also participated in many cultural and creative forums at home and abroad, exchanging experiences with several teams, learning valuable advice, and absorbing more inspiration.

The Forbidden City's has thus established bold and innovative sales channels. Traditionally, the main channel for selling museum products has been the physical store. It was found that the Palace's cultural and creative brand stores are set up at the places where the visitor streams pass, ensuring a significant number of potential consumers. In addition to the traditional sales, the Forbidden City has been very innovative, following the trend of the times by opening an online sales channel at the beginning of the rise of e-commerce, with an official flagship store on the sales platform Taobao in 2010. Online sales of the Palace products are rising, and the Palace Taobao store alone has more than 7 million fans. This shows that the Palace has combined both online and offline sales channels, using a variety of ways to sell its cultural and creative products, and getting good returns.

IP & Cultural Economy

On November 23rd, 2020, the China Association of Conservation Technology, China Forbidden City Society, and Beijing Palace Heritage Conservation Foundation co-sponsored the "First Cultural Heritage Conservation Young Scholars Forum" held at the National Palace Museum. This was the forum for young talents under the age of 40 employed the theme of "innovation-driven technology and practice of cultural heritage conservation ". Its goals was to build an academic exchange platform, to discuss the latest research results, academic developments and development trends, to encourage them to explore and innovate in the golden age of creativity, and to grow up as an important reserve force and future leader of high-level research and innovation teams in the field of cultural heritage conservation.

The Cultural Heritage Protection Young Scholars Forum is an important attempt made under the requirements of the new situation of cultural heritage protection in the new era. The success of the forum provided new ideas for the cultivation of young talents, and in the future, the Young Scholars Forum on Cultural Heritage Conservation will be held regularly, striving to make it an influential brand activity in the field of cultural heritage, and helping the growth of young talents in cultural heritage conservation.

Alternatives to museum creations are other categories with similar price points and much cheaper products of the same type: for example, duct tape, notebooks, charms, etc. We can see that museum creations have the additional layer of cultural connotation and heritage elements and have an irreplaceable appeal to the main target consumer groups of museum creations.

"Museum+": the Museum Plus Mode

The "Museum+" mode is a cross-border cooperation between museums and other industries to help museums better develop cultural and creative industries, form sustainable development momentum, and enhance the vitality of museums. In recent years, as the model continues to mature, the museum cultural and creative industry has formed the following characteristics: Providing multiple contents, wide ranges

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of products and experiences, a comprehensive structure and system, and the cultural utilization rate has gradually increased.

Through self-management, cooperative operation, and brand licensing, the Forbidden City employs a diversified cooperation strategy to transform the Forbidden City's cultural elements into diversified products, resulting in a variety of simple and practical cultural and creative products that are not lacking in cultural interest. The historical roots, cultural symbols, and stories behind the cultural relics in the collection are all intertwined in the majority of these objects. Simultaneously, the Forbidden City aggressively pursues cross-border collaboration with a variety of companies and businesses. This cross-border brand collaboration is the result of the businesses' appreciation for the Forbidden City's rich cultural legacy while also seeking a more modern representation of the Forbidden City's cultural contributions.

Taking the "Upped New, Old Palace" IP variety show of the Palace Museum in Beijing as an example, we analyze the operation mechanism of this "multi-chain" IP economy.

Figure 12. The relevance between IP products and the Innovation
Source: (J.-C. Tu et al., 2019)

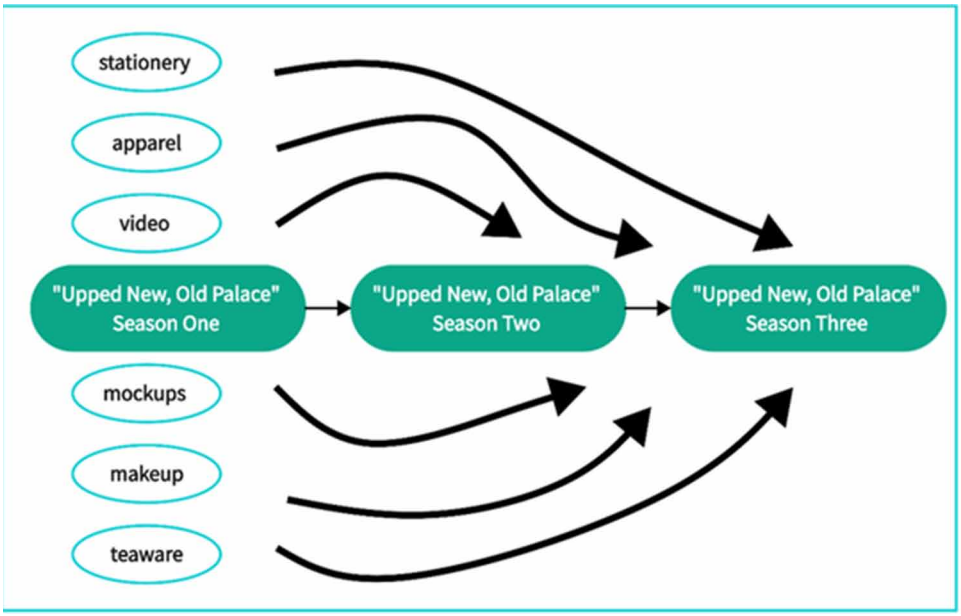


Figure 12 displays the relevance between IP products and the Innovation. The "multi-chain" IP economy of museum culture and creation has shown IP systematization and clustering and has built up an ecological platform with content IP as the core. For example, the show " Upped New, Old Palace", as a content IP of Beijing's Forbidden City culture and creation, firstly achieves visual impact and content communication through film and television IP, and vertically links to other product areas to expand and derive creative products such as makeup, teacups, pajamas, eye masks, jewelry, etc. under the Forbidden City culture and creation IP labeled with "Forbidden City Culture and Creation". The horizontal extension and expansion is via the IP series, being launched yearly as the "Upped New, Old Palace" Seasons (I), (II), (III), thus initially establishing the Forbidden City cultural and creative IP system for a broad

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audience. At the same time, this "multi-chain" model is replicable, based on the creation of the "I repair relics in the Forbidden City" IP system, the "Echoes of the Forbidden City" IP system, and the " Upped New, Old Palace" IP system, the clustering of IP systems eventually built the "Forbidden City cultural and creative" ecological platform (Tu et al., 2019).

DISCUSSION

Non-fungible Tokens in Museums

However, the issue of authenticity has been a contested issue in the context of the museum. Several researchers have asserted that high-quality museums should protect their value by adhering to authenticity, which is the heart of a museum's value and the element that distinguishes it from low-quality museums (Bevan et al., 2014). The environmental requirements for the appropriate preservation of artifacts are usually inconsistent with those for visitors to archaeology museums for example. Independently controlling the environments for the preservation of artifacts and visitors has proven to be an efficient and energy-saving strategy for archaeology museums displaying funerary relics in pits (Luo et al., 2016).

At present, the protection of intellectual property rights of museum products in China has not yet been implemented to the details, and imitations on the market have been widely used. Even museum management and staff have oftentimes not yet grasped the importance of intellectual property protection, and the staff needs to keep up with the times, constantly summarize the latest situation in practice, and also establish the ideal of lifelong learning to deal with new developments.

Non-fungible tokens (NFTs), which are cryptographically signed replicas of digital or physical assets that are publicly published on a blockchain, have technologically enabled the ownership and trade of digital assets (Yousaf & Yarovaya, 2022). NFTs were initially created in 2017 as a way for game players to exchange virtual items, however owing to recent technological improvements, they have started to become ubiquitous in 2021, even selected as the #1 Collins Dictionary 2021 Buzzword of the Year (Fortune, 2021).

In the case of the Chinese museum, NFTs are embodied in the digital products of the museum's cultural creation. The so-called digital collection can be seen as "NFT artworks". Through blockchain technology, each artwork has a unique digital code number, thus it can be transformed into a unique digital token and traced back to their origins. The application of NFT in the metaverse allows virtual objects to have real value. On October 29, 2021, the Hubei Provincial Museum's digital collection of the King Goujian Sword was officially released to the public, and 10,000 copies of the collection were sold out in half a minute online (F. Liu et al., 2022). In Chinese academia, different scholars have come up with different views. Some advocating studying American law emphasized the "minimum use of creativity"; Others advocating German law appealed that a work should reflect the author's personality in a high degree of creativity; the others maintained that both the author's personality and some creativity are essential (Xi et al., 2022).

With the current COVID-19 epidemic wreaking havoc on cultural heritage organizations' finances, museums and galleries have been forced to shift to revenue-generating strategies in order to stay afloat, considered by some as a potential "lifeline" for museums (Valeonti et al., 2021). The museum stakeholders, however, remain largely skeptical, as there are numerous risks involved. The risks are both from institutions (e.g., market implosion, or illicit exploitation of open content), as well as for buyers (e.g.,

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key loss and storage issues) (Subramanian & Subramanian, 2022). In the official document "National Cultural Heritage Administration on the third session of the thirteenth National People's Congress, No. 2986 proposal response" from National Cultural Heritage Administration, it demonstrated that museum digitalization is an important element and development trend of contemporary museum construction. The need to promote the construction of intelligent museums and the construction of museum big data system has been acknowledged (National Cultural Heritage Adiministration, 2020). In this context, the protection of copyright in NFT artworks requires powerful legislation to ensure the NFT art market can develop in a healthy direction. Given the very recent apparition of the NFT phenomenon and the changing legislation on blockchain technologies in China, this development is still extremely new and will have to be studied further in the next years.

IMPLICATIONS AND CONCLUSION

The Museums IP establishes the concept of "great cultural creation", provides intangible knowledge and services, and takes cultural creation into consideration, implementing the transformation from copied images towards independent brands, rather than relying entirely on traffic from the halo of museum collections themselves. Products for museums are no longer simple copies, but surround and include exhibitions, activities, and education to provide a comprehensive IP product system. From the perspective of content, the system is essential to the cultural creation of museums, - not forgetting to convey ideas while carrying out creative design on the appearance. From the perspective of acceptance, we can witness the use of multiple formats to create distinctive product experience; from the perspective of human nature, we witness the need to have a unique humanistic approach, which truly reflects the atmosphere of cultural creation. The three bodies complement each other and are indispensable.

Undisputedly, VR and other emerging technologies created a fundamental shift, necessitating in some cases a reinvention of traditional concepts on what the museum experience entails. Thus, a holistic understanding of the impact of VR is more critical than ever, since this will affect both the design of VR and its perception and acceptance by museum professionals and visitors alike. And museum practitioners and VR developers should emphasize the edutainment factors of VR, with a focus of helping to immerse visitors in a VR environment and to have an enhanced experience, which ultimately influences their intention to visit the actual museum. It is important to provide exact and plentiful information in a novel and captivating way.

To shape the brand image, museums must dig out the story behind the product, capture the emotional resonance of consumers, and then implement it. Behind each artifact in the museum is a profound historical connotation and story. These cultural relics, all with their own aura, have been widely recognized; Some historical stories and fragments are not well known to the public, so they need to be recreated and repackaged in the context of the present to give them background and meaning in the new era.

To solve the fundamental problems of cultural policy, it is necessary to define the relationship between the government and the market reasonably and legally, moving away from controlling the cultural industries through policy pronouncements and toward the rule of law to regulate and manage the industry.

Furthermore, it is urgent to transform the concept of public arts education for the virtual museum. That is to say, the goal of public arts education should shift from training people's artistic accomplishments to developing people's creativity. The founding idea of the virtual museum should shift from focusing on virtual reality technology to creating virtual reality products, the communication idea of a

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virtual museum should shift from emphasizing knowledge dissemination to establishing the experiential dissemination field.

Through the efforts throughout society, especially via the unremitting efforts of museum teams, there is a constant renewal of ideas and thoughts. Some exemplary museum development teams have borrowed the experience from China and the West, and deeply combined them with Chinese traditional culture, so that the Chinese museums' cultural and creative industry has grown from scratch, the level of creativity has grown from simple to refined, and the promotion strategy has been constantly innovated, which has enabled several museums and their collections to be "reborn". Since 2013, when the National Palace Museum in Taipei launched the "I know" tape[5], it has taken only seven or eight years for the museum industry and its collections to be reborn. in 2013, many museums in China have been able to create tens of millions or even hundreds of millions of dollars just by selling cultural and creative products. Today, more and more museums in China are trying to create cultural products, and there are more and more museums in China experimenting with cultural creation, and there are great practical breakthroughs in the development mode, development concept, product design, production, and sales.

The study of the current situation and problems is not only to provide an overview of the current stage of development of museum cultural and creative industries, but also a contribution to solving the current dilemma of museums' cultural and creative development. Furthermore, we hope to provide some useful ideas and suggestions for the future development of even more museums and point out the need for further academic research on these new developments, especially around museum NFTs.

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ENDNOTES

1 Tmall is a popular online e-commerce platform in China.

2 Shaoshan, the birthplace of the late Chinese leader Mao Zedong in central China's Hunan Province, remains one of China's most visited tourist destinations more than 40 years after he passed away, an epitome of the booming "red tourism" across the country (https://news.cgtn.com/news/3d3d414e30676a4d31457a6333566d54/index.html).

3 Digital culture creates more space for cultural and artistic imagination.

4 Museum derivatives are cultural products related to museums, and have a strong correlation with museum collections, exhibitions, and research.

5 This is a copy of the authentic work of Emperor Kangxi. The Kangxi Emperor (Xuanye; 4 May 1654 – 20 December 1722) was the third Emperor of the Qing dynasty. When Emperor Kangxi was correcting the document, he said "I know" at the end of the document, so the National Palace Museum in Taipei combined the domineering text with the paper tape.

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Chapter 12
Digital Transformation and Innovation Management: The Case of Small–Medium Enterprises in Lebanon

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ABSTRACT

Transformational entrepreneurship refers to the capacity of entrepreneurs to deal with global difficulties, such as the current economic crisis, to enhance the well-being of their local communities. Digital technologies have impacted the connection between entrepreneurs and small and medium-sized enterprises (SMEs). The survey was distributed online using Google forms between December 2021 and February 2022. The target population for the study included entrepreneurs owning small-medium enterprises in Lebanon. Additionally, the sample that is used for this study is 270 entrepreneurs (N=270). As a result, this study contributes to the body of knowledge by examining the relationship between technical preparedness and market expansion and the investigation and use of that technology. Understanding the relationship between macro-level policy changes and the national level is essential. Ultimately, the findings might help encourage developing and implementing cutting-edge technology-driven business strategies.

INTRODUCTION

Transformational entrepreneurship (TE) refers to the capacity of entrepreneurs to deal with global difficulties to enhance the well-being of their local communities. Digital platforms' ability to help TE to deal with the economic crisis as a result of the COVID 19 pandemic was examined in this research (Karimi & Walter, 2021). Despite the pandemic-imposed retail closures, SMEs were nevertheless able to provide

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its services thanks to the digital platforms in developing strategic alternatives according to Kreuzer et al. (2022). Market players may use this document to learn more about how this kind of technology might help small businesses in times of crisis. The outcomes might also serve as a model for other retailers to follow when dealing with the pandemic's aftereffects. An analysis of the COVID-19 pandemic provides a new perspective on the link between digital platforms and TE in the context of the pandemic. Digital platforms are being used to fulfil the ever-changing and expanding demands of entrepreneurs as a result of corporate choices (von Briel et al., 2021)

Across the globe, digital entrepreneurship has had a profound impact on the economy. Communication has been altered by the likes of Google, Twitter, Facebook, Apple, and Microsoft. Artificial intelligence now has a digital stage where it may improve decision-making and perception in real life according to Ji et al (2021). Entrepreneurship researchers and practitioners must guarantee that connected results are ensured in order to discover developing possibilities in the company as a result of digitalization, which creates multiple inferences via disruptive and fast change.

Entrepreneurship is defined in this research as the process of creating, launching, and managing a new company or trade. It has been shown that entrepreneurship is more than just starting a new firm because of its unique characteristics of producing new value. Entrepreneurship was explored holistically when institutions interacted with the education sector or formed firms, entrepreneurs, and stakeholders according to Ghobakhloo et al (2021). Entrepreneurial company models have undergone dramatic adjustments as a result of digitalization, which has created new digital business prospects. General enterprises have also migrated to the internet. Digital entrepreneurship is defined in this research as a kind of business that has made the transition from a conventional model to one based on technology. Selling digital products or services through automated networks is entrepreneurship, according to Karimi & Walter (2021).

It's not only information technology that drives digital entrepreneurship. In addition, digital entrepreneurship refers to an entrepreneurial activity that converts a conventional service, asset, or element of a firm into a digital one. Traditional entrepreneurs and digital entrepreneurs have a lot of things in common. Products, workspaces, and marketing efforts all differ significantly. Entrepreneurs have benefited from the rise of digital technology. Consequently, businesses must be prepared for long-term advancements in the field. Most of the works chosen concentrate on a subcategory of digital entrepreneurship, academic literature, and a systematic summary of the available review of digital entrepreneurship literature according to Ji et al (2021).

Research Problem

Some research focuses on how businesses can adapt to digital transition regarding the effects of digital transformation on small and medium enterprises in the creative industries. Digital technologies have impacted the connection between entrepreneurs and small and medium-sized enterprises (SMEs). Because much of this research is done quantitatively and in industry-specific situations, it's unclear whether the results can be generalized and replicated. The relevance of digital transformation in the business world is beginning to be recognized, and many businesses have started to use digital technology in their business models. Small-Medium Enterprises in Sweden seem to be making progress. However, there is still a lack of information on how this change has affected the country and if there are specific effects that apply to all organizations and not just those in specific industries.

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Significance of the Study

A wide variety of factors influences the capacity of Small-Medium Enterprises to implement a digital transformation plan. One main problem includes anything from the competition and technological readiness to the regulatory environment and a more holistic view. Digital transformation is being driven by technology and public acceptance of that technology. Platforms and infrastructures in digital technology have made it simpler to establish a new business or grow an existing one online. This has resulted in a recent entrepreneurial activity known as digital entrepreneurship. Innovation may be sparked through entrepreneurial activity, which has been shown to benefit the local, regional, and national economies. There has been a significant shift in the way entrepreneurs run their businesses in the digital age. This includes digital readiness, digital exploration, digital exploitation, agility and innovation.

Digital entrepreneurship was used to describe how digital innovation is embraced. Entrepreneurship is the creation of new businesses or the restructuring of existing ones to use cutting-edge digital technologies. Using new digital technologies to create new business models, such as social and mobile applications, digital firms are defined by the greater intensity in their usage of these technologies to enhance their capacity to communicate with consumers and stakeholders. Various disciplines, including corporate strategy and policy, have looked at digital entrepreneurship through the lens of digitization and digital transformation. Because of this, research has shown that technical advancements help businesses get a more significant portion of the market. Small-Medium Enterprises have constantly extended their market share thanks to the internet and technological advances. However, the study shows that technological innovation may significantly influence a Small-Medium Enterprise's growth despite the risks. Information technology preparedness, exploration, and exploitation are all tied to the development of the technology market via digital transformation and entrepreneurship.

DIGITAL ENTREPRENEURSHIP FROM A HUMAN CAPITAL PERSPECTIVE

Businesses and society as a whole are being transformed by digital technology. It's an issue for human capital, mainly digital entrepreneurship, in this dynamic time. The primary focus of digital entrepreneurship is creating new businesses and re-engineering existing ones. As a result, the sharing economy has emerged, uniting owners and users and breaking the conventional duality between enterprises and entrepreneurs according to Zahra (2021). Qualitative literature analysis and interviews with university personnel, professors, and students at four prominent public and private institutions in West Java and DIY Province have led to the development of an interpretative framework for digital entrepreneurship. This framework has three main components: motivation, stakeholders, and digital technology. This report includes several policy solutions for increasing digital entrepreneurship in the academic context. (Muafi et al., 2021)

It is essential to spot possibilities made possible by digital technology (DT) in today's digital environment. However, given the effect of DT, which disperses agency and distorts the margins between consumers, firms, goods, and sectors, opportunity detection is a considerable difficulty. Due to DT's impact on identifying opportunities, conventional entrepreneurial knowledge must be reconsidered and better understood. Based on the concept of opportunity recognition, this study uses a systematic literature review to detect and clarify DT's direct and transitive effects on opportunity identification. Real-world examples and conversations with academics and practitioners have supported these findings. In short,

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this research adds to our understanding of how old business models give way to digital ones. The results show how and why DT affects people's perception of opportunities, adding to the opportunity recognition hypothesis. This aids examination and practice in discovering and managing opportunities more efficiently. (Kreuzer et al., 2022)

THE ROLE OF TECHNOLOGY READINESS, EXPLORATION, AND EXPLOITATION IN TECHNOLOGY ENTREPRENEURSHIP

Through the study of technology entrepreneurship and technological market development, this research explores the influence of digital transformation on value creation. These principles are fundamental components of the dynamic capabilities required for a nation to embrace digital innovation properly (von Briel et al., 2021). Over seven years of relevant data from 28 European countries, a new perspective on digital enterprise was defined and studied, inspired by digital transformation and entrepreneurship concepts. Technology readiness, digital technology exploration, and exploitation are subcategories of the digital transformation process. Managers and practitioners may now make better-informed choices due to this study's addition to the body of knowledge. (Karimi & Walter, 2021)

Digital Technology Readiness

Technological readiness is the willingness of an individual to adapt and utilize new technology to achieve their objectives, both at home and at work. Using Technology Acceptance Model (TAM) (Ghobakhloo & Iranmanesh, 2021) emphasizes an individual-level approach to making decisions regarding the use of information technology. A preparation index created may also be employed. In this view, technological preparation rests on four pillars: confidence, creativity, discomfort, and insecurity. People's reactions to technology may be both good and negative. Technology readiness is boosted by optimism and creativity, whereas pain and uncertainty impede it. Whatever the approach to gauge a firm's preparedness, the organization must access and use digital technologies that might lead to a digital transformation (Ghobakhloo & Iranmanesh, 2021; Sahut et al., 2021).

There has been talking of a productivity paradox regarding ICT investment and performance. When it comes to creating new competitive advantages and redefining the Small-Medium Enterprise's strategy, ICT investments are critical (Kreuzer et al., 2022). Research on how to start a high-tech firm, what resources are best for getting started, and how education may be a key obstacle has been conducted in the preceding two decades. Many business owners cited education and internet access as the two most important aspects of their Small-Medium Enterprise's success, according to a study of more than 1,000 people. They listed education as an important factor in 46% of their replies and the internet as an essential effect in 44.8 percent. High school and college students' interdisciplinary cooperation must focus on entrepreneurship, technology, and real-world business experience(von Briel et al., 2021).

Digital Technology Exploration

Exploration is defined as activities aimed to enhance present product and process positions, while expansion is defined as actions meant to enter new product and process domains (Ji et al., 2021). According to the Small-Medium Enterprise's resource-based approach, resources/capabilities are critical to a Small-

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Medium Enterprise's ability to produce wealth. The success or failure relies on its resources and skills, the management, the Small-Medium Enterprise, and capabilities. Regarding strategic asset stock, such as research capabilities, R&D investment must be continued to achieve the fundamental transformation. In the long run, increasing R&D expenditures should lead to more in-house discoveries and an increased flow of new scientific information into the organization.

Digital Exploitation according to Ji et al (2021) refers to business concepts that make advantage of new technological developments and innovative approaches. Many different business models may be found in digital entrepreneurship, from commodities to workspaces to distribution methods. That's not the only inventive method to run a business, though, according to Karim & Walter (2022). Cloud services, big data, and artificial intelligence (AI) are all part of modern entrepreneurship. Several authors claim that digital entrepreneurs aren't restricted to using well-known platforms. They participate in digital engagement activities such as driving an Uber and taking advantage of opportunities at the flea market in order to promote economic efficiency and technological progress. A better future may be found by using digital media and information technologies in the quest for it. Digital media and information technologies provide opportunities for digital entrepreneurs.

Digital Technology Exploitation

Several disciplines have long held a common interest in digitization, including information systems, economics, politics, and management. Digital greatness can only be realized if we examine how firms in a particular environment 'become digital according to Karimi & Walter (2021)'. Examples include entrepreneur and partner engagement; business model innovation, process digitization; automation, digital security, and compliance, all of which entail direct connectivity with their ecosystems through user- and user-driven initiatives. Intellectual property as a formal institution affects the entrepreneurial behaviours of individuals since it gives new incentive structures for beginning a new business(Garcez et al., 2022; Steininger et al., 2022). To develop a whole new Small-Medium Enterprise, for example, a patent gives researchers a leg up. Independent Small-Medium Enterprise entrepreneurs may use intellectual property to compensate for the lack of financial resources. Entrepreneurial firms are also expected to spend a significant amount of intangible capital concurrently to address the new difficulties of digital transformation.

The Effect of Innovation on Digital Entrepreneurship

Female entrepreneurs' views on digital innovation (DI) are presented in this article as a response to the growing body of literature on the subject. The IDTGIT individual differences theory of gender and information technology is used to study how women entrepreneurs use digital technology to generate opportunities in response to social, cultural, and structural challenges to an individual's self-identity. Another way technology aids the social impact of DI Small-Medium Enterprises is by looking at how women entrepreneurs employ it in their DI ventures. This paper is based on an in-depth qualitative study with 17 Australian women entrepreneurs. Evidence suggests that women entrepreneurs are discouraged from setting up their enterprises by combining their sense of self, external factors such as societal and structural forces and internal factors such as lack of access to capital and other resources(Abubakre et al., 2021; Muafi et al., 2021). There are two main methods in which technology helps women entrepreneurs pursue innovation: technology-based innovation and technology-enabled innovation. Aside from educa-

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tion and employment, environmental and climatic change, community improvement, and healthcare are areas where DI has positively influenced SMEs according to Karimi & Walter (2021).

COVID-19 instances are on the rise all around the globe, and this is having a significant influence on many different areas of society. The unprecedented public health crisis has had a significant impact on the global economy, with firms shutting down and turning to digital platforms as a result. Entrepreneurs from all around the world have taken advantage of the enormous problems posed by the epidemic. Ji et al (2021) believed that digital technologies would be critical in surviving the crisis and even flourishing in the long run as they sought the recovery route. Young Filipino entrepreneurs' perspectives on digital innovation in micro, small, and medium-sized firms (MSMEs) are examined in this research. Using an inductive content analysis technique, researchers conducted in-depth interviews with 46 Filipino internet entrepreneurs using a qualitative approach. To counteract this trend, researchers looked at how the pandemic's negative effects, such as mobility restrictions, market conditions, and household economic status, encourage entrepreneurs to move their businesses to digital platforms. Digital entrepreneurship is hindered by a variety of factors, including a lack of digital platform expertise, a lack of high-quality internet infrastructure, and the pandemic limitations according to Ghobakhloo (2021).

The Effect of Entrepreneurial Agility on Digital Entrepreneurship

Digitalization has considerably altered and disrupted the economic, social, and commercial dynamics in recent years. This study relies on strategic entrepreneurship decision-making and the intellectual foundations of entrepreneurial agility, which are fundamental to this research. Entrepreneurial agility may be used to combine or integrate advantage-seeking behaviors for long-term processes and practices to build value in response to digital disruption in creating innovative products and business models. New product and business model innovation directly impact entrepreneurial agility, while increasing digital platform capabilities indirectly impact value generation via new business models. This study examines its theoretical and managerial ramifications for digital entrepreneurship research (Kašperová, 2021; Trongtorsak et al., 2021).

In this editorial piece, many theories of management and strategy have been applied inappropriately, such as by telling us what to observe rather than asking where our theory breaks and what is distinctive in the context of entrepreneurship. As a result of these factors, the West has limited influence on Asian entrepreneurship. To make matters worse, the predominant study on Asian entrepreneurship asserts that weak institutions stifle entrepreneurship. As a result, it focuses on how entrepreneurs in Asia overcame these obstacles as the primary entrepreneurship research program. Ultimately, the main goal is to free entrepreneurship research from its current binds and go beyond the confines of pre-defined constructions to uncover potentially innovative features of the entrepreneurial environment. In other words, its uniqueness must be used to expose the accepted theory's limitations and boundary constraints and liberate its hidden potential.

SAMPLE

The survey was distributed online using google forms between December 2021 and February 2022. The target population for the study included entrepreneurs owning Small-Medium Enterprises in Lebanon. The survey was administered in English, considered the second language used in Lebanon. Addition-

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ally, the sample used for this study is 270 Entrepreneurs (N=270). The following sections discuss the different instruments that were used to measure the variables of the study.

Instruments

The first section included a consent form that provides the choice for respondents whether to answer the questionnaire or not and reassures that the identity of the respondents will remain anonymous as a part of maintaining research ethics and confidentiality. Before distributing the questionnaire, it was approved by the Institutional Review Board (IRB).

The purpose of the questionnaire was to examine the mediating relationship between innovation and agility in the relationship of readiness, exploration, and exploitation with the digital transformation of SMEs. It is important to note that the survey consisted of eight sections. After the consent form, the second part included ten demographic questions. The questions included gender and age.

The third part measured technological readiness using ten adopted questions (Welter et al., 2019). Respondents rated their engagement activity on a 6-point Likert scale, where answers ranged between 1 (Never) to 6 (Always).

Moreover, the fourth section of the questionnaire concerned the technological exploration scale. The scale was adopted from (Wierenga 2020). Participants were asked to answer six questions using a 5-point Likert scale ranging from 1 (Never) to 5 (Always).

The fifth part of the survey included a 9-items scale to measure technological exploitation adopted (Stinchfield et al., 2013). Participants rated the items on a 6-point Likert scale ranging from 0 (Never) to 6 (Everyday).

The sixth part of the survey included three items to measure innovation and was adopted from (Tasavori et al., 2018). The items were measured using a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

The seventh and final part of the survey included three items to measure agility adopted from (Senyard et al., 2014). The items were measured using a 5-point scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

Descriptive Statistics

Table 1. Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	180	66.7	66.7	66.7
	Male	90	33.3	33.3	100.0
	Total	270	100.0	100.0	

According to the table for gender, 180 respondents were females, and 90 were males.

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Table 2. Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20-29	9	3.3	3.3	3.3
	20-29 years	153	56.7	56.7	60.0
	30-39 years	72	26.7	26.7	86.7
	40-49 years	36	13.3	13.3	100.0
	Total	270	100.0	100.0	

According to the table for age, the age of 9 of the respondents was between 20-29, and 153 of the respondents were between 20-29 years

However, 72 respondents were between 30-39 years, and 36 were between 20-49 years.

Regression One: Relationship between Technology Readiness, Exploration, Exploitation and Digital Transformation

Table 3. Relationship between technology readiness, exploration, exploitation and digital transformation

Model Summary							
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**			
1	.206[a]	.299	.495	.682			
a. Predictors: (Constant), Technology Readiness, Technology Exploration, Technology Exploitation and Digital Transformation							

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.164	.181		.908	.365
	Technology Readiness	.847	.057	.600	14.863	.000
	Technology Exploration	.842	.044	.452	19.136	.004
	Technology Exploitation	.393	.063	.245	6.229	.000
a. Dependent Variable: Digital Transformation						

Referring to the above regression analysis, it can be noted that Technology Readiness scored a P-Value (0.00), T-Test (14.863) and Beta (0.600), and the variable Technology Exploration scored P-Value (0.004), T-Test (19.136) and Beta (0.452) and the variable Technology Exploitation scored P-Value (0.000), T-Test (6.229) and Beta (0.245) and by that the null hypothesis will be rejected and the alternative one will be accepted, and thus:

- H1a: There is a positive impact of technology readiness on digital transformation is accepted

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- H2a: There is a positive impact of technology exploration on digital transformation is accepted
- H3a: The is a positive impact of technology exploitation on digital transformation is accepted

Digital Transformation = 0.164 + 0.600 Technology Readiness + 0.452 Technology Exploration + 0.245 Technology Exploitation

And this means that:

- For every one-unit increase in Technology readiness, digital transformation tends to increase by 60 units
- For every one-unit increase in Technology Exploration, digital transformation tends to increase by 45.2 units
- For every one-unit increase in Technology Exploitation, digital transformation tends to increase by 24.5 units

However, the model scored an R of 20.6%, which means that 79.4% of the variables mentioned in this model tend to impact digital transformation and that 29.4% of the variables are not said.

Regression Two: Mediation Effect of Innovation on the Relationship between Readiness, Exploration, Exploitation and Digital Transformation

Table 4. Mediation effect of innovation on the relationship between readiness, exploration, exploitation and digital transformation

Model Summary							
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**			
1	.699[a]	.489	.481	.83548			
a. Predictors: (Constant), Technology Readiness, Technology Exploration, Technology Exploitation, Innovation and Digital Transformation							
Coefficients							
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	
		B	Std. Error	Beta			
1	(Constant)	.383	.280		1.367	.173	
	Readiness	.553	.070	.412	7.961	.018	
	Exploration	.513	.073	.459	7.041	.000	
	Exploitation	.370	.089	.252	4.156	.000	
	Innovation	.105	.046	.105	2.280	.023	
a. Dependent Variable: Digital Transformation							

Referring to the above results, it can be noted that the variable readiness scored a P-Value (0.018) and T-Test (7.961) and scored a Beta (0.412), as for the variable exploration it scored P (0.00), T-Test (7.041)

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and Beta (0.459), as for the variable exploitation it scored P (0.00), T-Test (4.156), and Beta (0.252). At last, the variable innovation scored a P (0.023), T-Test (2.280) and Beta (0.105). From the above, it can be noted that there is a significant relationship between readiness, exploration, exploitation, innovation and digital transformation since the P-Value is lower than 0.05.

However, the following equation can be deducted:

$Y = A + BX1 + BX2 + BX3 + BX4$ which means

Digital transformation = 0.173 + 0.412 Readiness + 0.459 Exploration + 0.252 Exploitation + 0.105 Innovation

This means that:

- For every one-unit increase in readiness, digital transformation tends to increase by 41.2 units
- For every one-unit increase in exploration, digital transformation tends to increase by 45.9 units
- For every one-unit increase in exploitation, digital transformation tends to increase by 25.2 units
- For every one-unit increase in innovation, digital transformation tends to increase by 10.5 units

As for the R^2 it had increased from 20.6% to 69.9%, meaning that innovation mediates the relationship between readiness, exploration, exploitation and digital transformation.

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Regression Three: Mediation Effect of Agility on the Relationship between Readiness, Exploration, Exploitation and Digital Transformation

Table 5. Mediation effect of agility on the relationship between readiness, exploration, exploitation and digital transformation

Model Summary							
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**			
1	.685[a]	.469	.461	.57937			
a. Predictors: (Constant), Technology Readiness, Technology Exploration, Technology Exploitation, Agility and Digital Transformation							
Coefficients							
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	
		B	Std. Error	Beta			
1	(Constant)	.344	.175		1.965	.183	
	Technology Readiness	.480	.048	.492	10.657	.019	
	Technology Exploration	.322	.051	.423	6.256	.000	
	Technology Exploitation	.412	.032	.417	12.875	.020	
	Agility	.178	.043	.262	4.156	.000	
a. Dependent Variable: Digital Transformation							

Referring to the above results, it can be noted that the variable readiness scored a P-Value (0.019) and T-Test (10.657) and scored a Beta (0.492), as for the variable exploration it scored P (0.00), T-Test (6.256) and Beta (0.423), as for the variable exploitation it scored P (0.020), T-Test (12.875), and Beta (0.417). At last, the variable agility scored a P (0.00), T-Test (4.156) and Beta (0.262). From the above, it can be noted that there is a significant relationship between readiness, exploration, exploitation, agility and digital transformation since the P-Value is lower than 0.05.

However, the following equation can be deducted:

$Y = A + BX1 + BX2 + BX3 + BX4$ which means

Digital transformation = 0.183 + 0.492 Readiness + 0.423 Exploration + 0.417 Exploitation + 0.262 Agility

This means that:

- For every one-unit increase in readiness, digital transformation tends to increase by 49.2 units
- For every one-unit increase in exploration, digital transformation tends to increase by 42.3 units
- For every one-unit increase in exploitation, digital transformation tends to increase by 41.7 units
- For every one-unit increase in agility, digital transformation tends to increase by 26.2 units

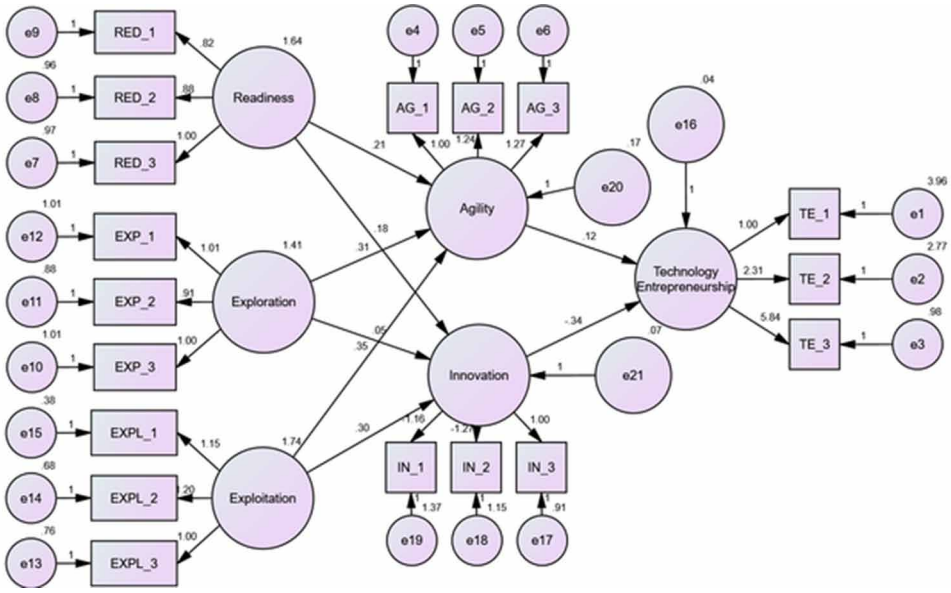
As for the R^2 it had increased from 20.6% in regression one to 68.9% in regression three and decreased from 69.9% in regression two to 68.9% in regression three. This means that agility mediates the relation-

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ship between readiness, exploration, exploitation and digital transformation but innovation tends to have a higher impact on the mediating effect among the variables since it scored a higher R^2

Structure Equation Model

Figure 1. Structure Equation Model



Referring to the above structure equation model, it can be noted that readiness tends to impact agility by 0.21 units, exploration tends to impact agility by 0.31 units, exploitation tends to impact agility by 0.35 units, and agility impacts technology entrepreneurship by 0.12 units.

As for innovation, readiness affect innovation by 0.18 units, exploration tends to impact innovation by 0.05 units and exploitation tends to impact innovation by 0.30 units, and in turn, innovation impact technology entrepreneurship by 0.34 units which means that both innovation and agility mediate the relationship between readiness, exploration, exploitation and technology entrepreneurship.

RESULTS

Technology Readiness

The digital era has begun due to technological advancements in digital media. Entrepreneurs must keep pace with the digital revolution to thrive in today's digital world. The study of brand building and development has become a significant focus. This study examines how their technical preparedness affects entrepreneurs' digital buying intentions. Businesses with high technological readiness are more willing to accept and try new products or services produced by a brand's application of digital technology because they have a more optimistic and innovative attitude toward digital technology, according to this study's

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findings; similarly, businesses with low technological readiness are less willing to accept and try new products or services because they have doubts and distrust of digital technology and have a common driving belief Digital technology has a positive effect on business expansion. An increase in production efficiency and reduced energy usage is achieved through the use of digital technologies. Thus, the rise of the digital economy also positively impacts the energy-saving economy.

Technology Exploration

An essential aspect of entrepreneurship training is that it bridges academic theory and real-world experience, which is critical for fostering the next generation of innovators. It describes the process of assisting entrepreneurs in developing the necessary expertise, attitudes, and abilities to achieve their objectives. It also refers to the industry contacts and practical experience critical for promoting future entrepreneurial success. This makes developing a unique teaching methodology and focusing on advanced courses necessary for entrepreneurship education to be as successful as possible. Meanwhile, technological innovations and their disruptive impacts have profoundly impacted almost every facet of our society. With the current digital transformation wave enabled by innovative technologies like the Internet of Things, augmented reality, and artificial intelligence, new possibilities have been opened up for entrepreneurs and innovators.

Technology Exploitation

Entrepreneurial activity and the expansion of the technology market are studied in the final hypothesis testing. The path analysis test was utilized, which offers the optimal data synthesis for examining the connection between technical exploitation and technology use. Technological market expansion has a set influence compared to the unpredictable nature of entrepreneurship.

Entrepreneurs' undiscovered demands may now be solved thanks to new technology. It's possible to create self-driving cars and minimize traffic deaths while improving driver comfort in congested areas thanks to integrating sensors and digital video with enormous road regulatory data sets made possible by data homogeneity and artificial intelligence (AI). It illustrates how digital technology can produce new value via diverse business models such as pay-per-use for physical items and unique user interactions.

Enterprise (disruptive) innovation occurs when new business models replace current ones that depend on face-to-face contacts, such as automotive service appointments, taxi services, or police enforcement of speeding penalties. Entrepreneur relationships are becoming more fragile due to digital technologies' quicker scale and enhanced autonomy. Digital servitization and self-service interfaces may challenge traditional notions about how businesses operate in the digital world. This brings attention to entrepreneurial activity relating to this new phenomenon. Using technology like artificial intelligence (AI) or crowdsourcing/crowdfunding, as well as stage theories that have guided the product development process for decades, digital entrepreneurship might help alleviate resource scarcity, as we'll discuss in further detail below.

As a result of the network externalities prominent in many new digital Small-Medium Enterprises, the traits of digital entrepreneurship indicated above become even more crucial for value generation. In this way, entrepreneurs become an intrinsic element of the Small-Medium Enterprise's value proposition. As a result, the more users a Small-Medium Enterprise has, the more value it might make. This adds a layer of complexity to cold start enterprises and emphasizes building a solid resource base that

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includes a critical mass of people and data. For startups with limited resources, these intrinsic qualities of digital entrepreneurship generate difficulties. Startups are encouraged to operate on the fringes of what is legally acceptable or take advantage of unregulated regions by these tensions.

Digitization creates new players such as platforms and two-sided marketplaces. When platforms step in to function as a go-between, it alters how new businesses engage with their suppliers and consumers alike. For example, equity and reward-based platforms have emerged as critical entrepreneurial financing actors, bringing supply and demand together. Traditional suppliers of entrepreneurial funding, such as banks, business angels and venture capital Small-Medium Enterprises, adapt to this dynamic and become active participants on these platforms. There has been a great deal of discussion in the academic community about the relative merits of equity crowdfunding versus more conventional sources of capital. The quality of the financed enterprises and the receptivity of traditional entrepreneurial financing sources to crowdsourcing will determine this issue. Entrepreneurs may access a wider audience through digital platforms like Uber and 99designs, allowing them to expand their potential client base and market share. Greater reliance on media and increased competition severely affect margins, profitability, and unintended consequences.

The Mediating Effect of Agility on Digital Entrepreneurship

Its views of possibilities and threats primarily determine a corporation's strategic entrepreneurial initiatives in response to agility. Thus, threat perception leads to resource allocation and routine rigidity, but opportunity framing leads to business model innovation. It's feasible to make a strategic option to transition to a new organization model even though risk perception is the opposite of opportunity perception. Strategic foresight is a manager's cognitive ability to think ahead when forecasting obstacles and potential in a quickly changing business environment. The capacity to anticipate how organizational resources and capabilities may be leveraged to develop value through business model innovation is crucial when exploring possibilities. The ability to detect and grasp fresh opportunities has also been related to growing knowledge, talents, and insights. A systemic understanding is an entrepreneurial cognitive aptitude to envisage technology-enabled business potential and associated threats while initiating aggressive actions for new products or services and forecasting competitors' future countermoves. The new struggle for many industrial firms is using insights from data-enabled business models to drive product and service offerings to produce value.

Technology-enabled product disruption is best served by building data-enabled business models. Now that numerous sources can be incorporated into standard data formats, organizations may utilize machine learning algorithms to observe metrics dynamically and generate insights. Because of this connection between a Small-Medium Enterprise's technology roadmap and value, new business models and product and service offerings are being launched, and existing channels are being used to push them, including (1) analytics and insights-based services, including dealer-enabled solutions and operations and maintenance operations); (2) data monetization, including insurance-rate optimization based on driver behaviour); and (3) a developer platform for third-party services.

Taking action in response to a disruptive incident is difficult when a corporation lacks knowledge of the relevant risks. It is vital to have systemic insight to recognize, grab, and transform resources and opportunities to reconfigure standard capabilities to develop a spectrum of dynamic capabilities, much like opportunity foresight. When managers think about a problem and examine their choices, they use mindset to characterize their decision-making process. Having an entrepreneurial mentality is both a

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personal and a communal attribute. A growth-oriented mentality refers to critical decisions to engage in SE to create flexibility, creativity, constant innovation, and regeneration. Think of it as a style of looking at a business that highlights the benefits of unpredictability. Everyone in the firm must embrace this attitude to motivate and push each other and consider that everyone must do their share to develop newness.

Executives and top management teams can comprehend the identical objective issues in distinct ways, culminating in varied strategic options and actions. To be an entrepreneur, you must have an entrepreneurial spirit and continually seek new prospects. As part of building and sustaining a digital mindset, it is necessary to identify a long-term digital vision. To avoid being dazzled by the potential advantages of disruptive innovation, it's essential to have an attitude of openness to new ideas and a readiness to recognize the need for change. Creating value also demands a Small-Medium Enterprise's capacity to undertake entrepreneurial experiments, take risks, and innovate despite earlier failures.

The Mediating Effect of Innovation on Digital Entrepreneurship

A substantial shift in the definition of openness to innovation has occurred due to digitalization. It is open because it may be accessed and updated by a program or digital object other than the one that rules its behaviour, for example, a digital resource. Because of the creative outputs of digital platform design, other entities may build on and complement one other. Entrepreneurs can collaborate in an open ecosystem or community to create and establish enterprises where everyone has a say in the decision-making and governance. As a result, the definitions of who may participate, what they can contribute in terms of inputs and resources, how they can contribute to processes and governance, and why they can participate in innovation and entrepreneurial results have been expanded by digitization. Studies have been done on the impacts of openness at different degrees—entrepreneurs' motivations for participating in collaborative, crowd-based entrepreneurship and innovation ideas. For example, how to open a digital platform architecture and the boundary resources that a platform owner wants to share with complementors, how open knowledge flows into a product development project, or how available specific phases of an innovation/entrepreneurial process should be, Small-Medium Enterprises can decide how open their innovation or entrepreneurial initiatives are in many different ways. As a result of open innovation efforts in government, entrepreneurs and democratic ideals are encouraged. Most of these research streams have either disregarded or only indirectly investigated openness problems that cross many levels of study. Furthermore, These questions illustrate that openness-related characteristics that boost innovation and entrepreneurship at one level may not be as effective at a higher level. As a result, connecting issues at various levels of study may help develop policies that encourage innovation and entrepreneurship in ways that benefit individuals, organizations, and society as a whole.'

As a further bonus, they may be utilized to bring together ideas and theories drawn from many academic disciplines. Examine the potential benefits of data openness provided by digitalization in fostering healthcare innovation and entrepreneurship. Using machine learning, entrepreneurs can create more innovative goods and services because they can access so much information about their clients. Small-Medium Enterprises and entrepreneurs may find themselves at odds when enabling consumers to choose what information they disclose and with whom. The dilemma of openness, or the tension between value creation and value appropriation, is also referred to in this context. Using open digital health platforms, data from various consumer health settings may be gathered and analyzed to lead to new business models and creative solutions to pressing public health issues. However, the requirement

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for openness in such initiatives may collide with the privacy needs of individuals and the desire of Small-Medium Enterprises to secure their data platforms (and associated data assets).

A single-level focus on open data-related problems appears unlikely to be helpful, given that the recommendations from such research will either be considered impractical or encounter resistance at other levels. On the other hand, research involving many levels of analysis may lead to policy and managerial recommendations that bridge these gaps while also revealing potential conflicts. Research on the overlap and competing motivations on digital health platforms at the individual, corporate, and societal levels might influence innovative business strategies and public policy. Furthermore, openness may be critical in enabling the multiple players and resources needed to deal with complex societal issues like achieving intelligent energy use in social housing. Resolving this problem will require a deeper understanding of the frictions between different stakeholders and how digital mechanisms can be used in conjunction with non-digital approaches, which puts a greater emphasis on the concepts and constructs inherent in digital technology. While digitization has made it possible for new partnerships, sharing resources, and co-creating knowledge, it is necessary to investigate how new mechanisms could help resolve the competing forces at different levels.

Theoretical and Practical Contributions

The research findings provide substantial additions to the literature that covers the diverse facets of digital transformation, therefore giving vital theoretical and practical contributions. For example, the study of Karimi (2021) focused on technological readiness has indicated that skills are a substantial antecedent of an organization's strategic flexibility impacted by innovation. The research has taken this further by investigating how the effect of digital technology on digital entrepreneurship as a vital driver to socio-economic growth at all levels. This research has significant implications for business research and management practice, as it educates managers who are looking to utilize the potential of digital technologies, technological advancements and their applications to create strategic flexibility. Furthermore, as entrepreneurs continuously interact with increasingly digital value chains, the approach to digital technology entrepreneurship adds to recent insights and guidelines that help practitioners understand and manage the dynamic digital infrastructure of the SME and thus the boundaries of their business processes.

This research draws on the abundant material of digital transformation and presents a framework that encompasses technological readiness, exploration and exploitation. Moreover, lately organizations have been putting into practice activities that study and exploit new digital technology developments, which has called attention to the link between technology and entrepreneurship. Consequently, the present research adds to the literature by emphasis on the influence of technology readiness, exploration and exploitation on technology entrepreneurship.

However, minimal progress has been achieved on the examination of this link at a national level, which leads to a need for adequate macro-level policy reforms. Therefore, the last key addition of this research is its country-level analysis. From a larger perspective, the results contribute to the creation and the acceptance of new and revolutionary technology-driven business models with the ability to promote growth at all levels. A need for most SMEs as a consequence of the present digital revolution of businesses and society, adaption of existing business models to the new environment necessitates a considerable change in the priorities of the organization.

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The results expand the previous research of authors such as Garcez (2022) on this area outside the context of SMEs, to assist practitioners rethink their strategy to manage the effect of digitalization and enhance their performance at a time when digital transformation is testing their business models. Another significant area of business study and practice that benefits from the research results is knowledge management, notably in the link between technological readiness and innovation, and their influence on digital entrepreneurship.

Also in terms of practical contributions, this study has found new facilitators of digital transformation as well as sectors that may not necessarily contribute to an increase in technology-driven entrepreneurship. In achieving these aims, the study informs the efforts of Lebanese policymakers in outlining initiatives that support digital transformation strategies at the macro level, thus responding to recent calls from entrepreneurship scholars such as _____ for research that goes beyond the industry background to consider internationality aspects of digital entrepreneurship

CONCLUSION

Entrepreneurship has grown significantly during the last decade. Digital technologies, platforms, and infrastructures must be considered to achieve such a transformation. Different thoughts and concepts must be woven together to understand the digital transformation's economic effect completely. This research aims to expand our knowledge of digital entrepreneurship by focusing on technology entrepreneurship and how it influences the technological market growth.

Consequently, the research helps practitioners better understand and manage their organization's increasing digital infrastructure and the limits of their business processes as they connect to further digital value chains. In light of today's digital upheaval in the workplace and society, this study teaches entrepreneurs to rethink their Small-Medium Enterprise strategies. It is recommended that subsequent studies concentrate on a particular context and expand on the core data acquired in the first place. In addition to the data collected at the national level, additional sources of information, such as interviews or Small-Medium Enterprise data, might be used. Consequently, the analysis would be improved, allowing for more significant contributions. Technological ambidexterity may now be used to study the relationship between the concepts of knowledge and technology ambidexterity. To deal with the strategic and operational difficulties connected with digital transitions, practitioners may benefit from a greater understanding of how information may be discovered and used from many sources of technical data through this link. Research into how cultural differences such as demographics, psychological characteristics, entrepreneurship education, expertise, and industry knowledge and networks in different countries may affect the adoption of digital entrepreneurship and why some digital strategies cannot be transferred to other cultures without overcoming certitudes could be carried out.

However, this does not rule out the possibility of studying the digital transformation's influence on technology entrepreneurship and the growth of specialized markets differently. Businesses and society may benefit from digital innovation if they are better equipped technologically, conduct research, and use digital technology to their advantage. Frameworks like this allow researchers to start thinking about integrating concepts from other fields, including digital transformation and perceptions of innovation and entrepreneurship. To better understand the interplay between digital transformation, technology entrepreneurship, and technical market development, academics and practitioners are urged to delve into new areas of inquiry. Although our plan hopes to inspire additional study in this area.

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Chapter 13
Digitalization in Rural India: A Step Towards Socio-Economic Transformation Amid the Pandemic

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ABSTRACT

This chapter demonstrates how the digitalisation of welfare schemes aiming at marginalized people has proven to be an effective tool for socio-economic transformation in rural India. It aims to advance and offer the argument in favour of e-governance-led digitalization for the multidimensional benefits to the entitled beneficiaries in India. Digitalisation has facilitated the implementation of e-governance, leading the government in building all interconnected and interlinking nexuses of different segments of society through the use of ICT over the digital space.

INTRODUCTION

In the post-reform period, India has registered an impressive economic growth rate. The high growth rate has been fuelled by a series of regulatory reforms and liberalisation of the economic system to promote foreign investment in the country. Despite the rapid economic growth, nearly 47 percent of the workforce is employed in the agriculture sector as of now, which contributes about 18 percent of the country's Gross Domestic Product (GDP) (see, Kumar, 2021). Besides, a majority of the workforce from the non-farm sector is engaged in the informal private sector. Even as of now, the vulnerable source of employment for the male and female workforce accounts significant portion of the total employment in India. They are living in rural areas with limited access to modern infrastructures such as banking, health, education and other ICT based services and devices (see, Kumar, 2021). In fact, the benefits of the rapid economic growth have mainly been confined to the Indian urban centres during the post-reform period.

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India is a home of over 1.35 billion population, with a significant number of people living below the socio-economic benchmarks. They include labourers, rural and urban poor, women, children and people belonging to socially disadvantaged sections of society. Since independence, successive governments have started a large number of welfare programmes for the socio-economic upliftment of the marginalized people. However, the lack of information and potential leakages in the monetary benefits aimed at the poor has been an all-time high challenge. The government recognises these facts, leading to the adoption of the E-Governance system for the equitable distribution of resources and delivery of welfare programmes at identical times.

Digital transformation implementation seems to be unavoidable at fast changing time if a government wants to respond to the challenges of globalization and urbanization of economic activities. Public organizations responsible for delivery of welfare schemes must modernize by integrating their activities with a new digital environment for wider reach in short possible time, which provide them with the opportunity to develop effective and transparent solutions to complex problems through digitalisation for socio-economic transformation of the people. The ICT revolution which took place during 1990s in India has benefited the economy in particular and common people in general. In the last decade, the expansion of ICT has led the Government of India (GOI) the adoption of E-Governance for the delivery of governance in a smooth, faster, and transparent manner.

Digital technologies have been a key driver in modern globalised world. Organizations responsible for delivery of public schemes need to integrate these technologies and their capabilities to compete and strive in the digital world. In the age of fast coming technologies, the business model innovations by the corporate and Government levels, allowing them to deploy a wider range of models for faster outreach and wider participation of the people (Chen, 2020). Now there is wide use of E-Governance in all forms of governance system like Government to Government (G to G), Government to Business (G to B) and Government to People (G to P).

The implementation of the E-Governance has brought dynamic changes for government in the form of mobilisation of resources, for businesses in the form of market, marketing and processes, and for people in the form of knowledge and getting of cash and non-cash benefits under welfare programmes without any leakage. Time and distance which had been an impediment between government and people for long years in countries like India have now bridged with the adoption of E-Government, especially in the implementation of welfare schemes. Potential benefits of digitization include increases in productivity, innovations in value creation, as well as novel forms of interaction with people, resulting in the shifting from existing model of functioning to new business models (Downes & Nunes, 2013). In order to achieve these objectives, organisations engage in activities towards standardizing and automating their processes.

Sustainable high economic growth requires the inclusive socio-economic welfare of marginalized people from different sections. Because of the poor implementation, the welfare programmes which were designed for the welfare of marginalized people had been failed in addressing the main purpose for a long time in the past. The leakages in the cash and non-cash benefits aiming at the poor, and high-level corruption in government agencies that were responsible for the implementation of policies, have been the common faults. They have been acted as obstacles in reaching the full benefits to entitled beneficiaries.

Digital transformation at the government level of welfare schemes has the capacity to introduce new processes and mechanisms that will maximum benefits in a transparent manner that can affect the key structures and performance of a target group of people of an economy. It provides access to the actual data regarding the number of target beneficiaries and insights that can help maximize the government performance in targeting the actual beneficiaries. As of now, the GOI focuses on the use of information

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technology for transferring the incentives under the different welfare schemes to the right person without delay. In fact, the existence of ghost/fake beneficiaries in developing countries like India causes subsidy diversion or leakages on large scale. This gives rise to a significant fiscal burden, leading the government to curtail or diversion of funds from one welfare programme to another.

The ghost beneficiaries also give rise to the corruption in public agencies responsible for the implementation of welfare programmes. To overcome these problems, India started 'Digital India' in July 2015 with the objective of empowering the people for the fast delivery of welfare programmes and curtailing information asymmetries. Now the notion of Digital India has done phenomenal progress in the areas of apps and web portals for the dissemination of information and delivery of public services (see, Pattnaik, 2018).

E-Governance has gained importance in public organisations as a delivery vehicle since the early 2000s; however, a major boost has been witnessed after the introduction of the Digital India programme in 2015. Since then, a good number of studies for example Saini et al. (2017); Nimbrayan, Tanwar and Tripathi (2018); Churchill and Marisetty (2019); Cavoli, Onur, and Sourdin, (2020) examine the role of E-Governance in public organisations dealing public utility services however the current paper attempt to analyse how the E-Governance has benefited the entitled beneficiaries under the different welfare schemes. Over the years, India's experience in E-Governance has demonstrated significant success in achieving its objectives such as reaching the poor, reduction in corruption in public agencies, and reducing in leakages of subsidies aiming to the marginalized people (see, Das and Chandrashekhar, 2007). The E-Governance success is also observed in eliminating the leakages in the world largest Public Distribution System (PDS) in India, wherein necessary food articles are distributed to the marginalized section of the society (see, Pattnaik, 2018).

This chapter demonstrates how the adoption of ICT based E-Governance has facilitated the marginalized people in providing direct benefits under the different welfare schemes in the process of social-economic reforms for inclusive growth. The purpose of this chapter is to assess the role of digital transformation in welfare schemes aiming for poor and specifically to evaluate the comparative performance under the critical time period like COVID-19. This chapter offers the testing of the given benefits of E-Governance in the wider spectrum of model choices as well as establishes an exploratory method for studying the benefit analysis in terms of reaching the benefits of E-Governance to the marginalized people.

The organization of the rest of the paper is as follows. The next section presents the facts on the digital infrastructure and digital literacy in India. It underlines the visible divide in rural-urban India in terms of digitalization and usage of ICT-based digital services in the country. In the following section, we show how digitalization has promoted social financial inclusion in the county. The fourth section presents the facts that due to digitalization, the Government has been successful in targeting the entitled beneficiaries under the different welfare programmes in India. The fifth section underlines how ICT-enabled E-Governance has been proved a blessing for the poor in getting the cash and non-cash benefits from the Government during the pandemic. The sixth section presents the concluding remarks in the context of policy implication.

Digitalization and Digital Literacy

The effective adoptions of digital technologies are considered as one of the main digital transformation drivers. As a matter of fact, solely applying digital technologies is not enough to drive digital transformation unless there are sufficient digital capabilities, digital strategies, and a new normal with the

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technologies by the general public to ensure successful digital transformation. Digitalization and digital literacy are the foremost need for the success of E-Governance in the delivery of welfare programs. Digitalization amounts to the availability and use of ICT-based services and devices by the people in the country. Digital literacy on the other hand stands for the skill set which is needed for the successful use of ICT infrastructure. It highlights the ability of an individual to understand and to use digital devices for meaningful actions. Any individual who can operate ICT devices like computer/laptop/tablet/smartphone and can make use of other ICT technologies is being considered as digitally literate. Digital literacy supports digital inclusion in the country which allows the deprived people and other tribal communities living in remote areas to benefit from the welfare programs of the government, besides empowering them on health and society as a safeguard against any form of exploitation.

The other prominent upcoming digital technologies that are leading a dramatic shift in the working of Governments and business organisations are cloud computing, social media, mobile technology and big data, have a significant role to play in digital transformation of economy in general and public in particular (Fitzgerald *et al.*, 2013; Lucas *et al.*, 2013). The rise of the ICT (including software) industry in India during the 1990s in the line of developed and fastest-growing economies has changed the business processes and delivery systems. As of now, India comes to be one of the largest exporters of ICT services (see, World Development Indicators, World Bank). After China, India is the second-largest subscriber country of the internet besides the second largest online market all over the world (see, Pradhan Mantri Jan-Dhan Yojana, GOI). Internet usage and mobile phone ownership per head have grown rapidly over the years. Table 1 summarizes some broad indicators of digital literacy in India. The total number of internet subscribers (wireless+wireline) per 100 people in India stands at 60.73, with this number being around 3 times higher for urban India (107.30) compared to rural India (36.24) (Telecom Regulatory Authority, GOI). Contrarily, the gap in access to the internet between rural and urban India stands significant. India has the highest number of disconnected people, despite being the home of the largest computer professionals among the others. With total subscribers of 1624.6 million (wireline +wireless), rural India internet subscribers (322.77million) are nearly half to urban India (502.53 million) subscribers (see, Telecom Regulatory Authority, GOI).

As per estimates based on the National Sample Survey (NSS) for households that 4.4 percent of households in the rural area own a computer as compared to 23.4 percent of urban households (see, Mothkoor and Mumtaz, 2021). The 42 percent of urban households have access to the internet while the corresponding numbers for rural households are 14.9 percent. By occupation, households that receive regular wages/salaries from non-agricultural occupations have the highest percentage of digitally literate at 53 percent in rural India. While the casual workers in the agriculture sector have the lowest level of digital literacy at 13 percent. In contrast, digital literacy is highest among regular wage/salaried workers at 73 percent and lowest among casual workers at 30 percent in urban India (see, Mothkoor and Mumtaz, 2021). Over 60 percent of women belonging to 12 states and Union territories from India have never used the internet (National Sample Survey, GOI). Accordingly, only 20.6 percent of women in Bihar used the internet, followed by 21 percent in Andhra Pradesh, and 22.9 percent in Tripura, while the corresponding numbers for males in the three states are 43.6 percent, 48.8 percent, and 45.7 percent respectively who have used the internet (see, National Sample Survey, GOI). These figures highlight the asymmetric distribution of digitalization in India.

This asymmetric digitalization demonstrates the visible digital divide in India, leading to the potential challenges and constraints for the implementation of E-Governance in the country. It is important to note that the rural-urban digital divide is not only an important issue for developing countries like India, but

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important places like USA and China are also finding it difficult to provide access to ICT based services to the people living in remote areas (see, World Economic Forum).

Table 1. Indian telecom services performance indicators (as on 31 March 2021)

	Urban	Rural	Total
1.Telecom Subscribers (Wireless+Wireline)			
Telecom Subscribers (in Million) bracket denotes wireless subscribers	663.77 (645.20)	537.42 (535.75)	1,201.20 (1,180.96)
Tele-density (wireless+wireline, in %). bracket denotes wireless Tele-density	141.03% (137.08%)	60.27% (60.08%)	88.17% (86.68%)
2.Internet/Broadband Subscribers			
Total Internet Subscribers (wireless+wireline, in million). Bracket denotes wireless subscribers	502.53	322.77	825.30 (799.30)
Total Internet Subscribers per 100 population	107.30	36.24	60.73
Source: Telecom Regulatory Authority, GOI			

Digitalization and Social Financial Inclusion

The developing countries like India face multifaceted challenges on the operational part of digitalisation of resources and access by the end users. The limited digital capability in terms of infrastructure, lack of skilled human resources, and technical barriers, limited access to financial resources, lack of managerial skill, lack of technology knowledge, and restricted infrastructure availability, that restrain them from growth and development of the marginalised households (Chen et al., 2021).

Financial inclusion which also means empower people digitally stands for empowering the marginalized section of the society financially. It is the process of ensuring access to useful financial products and services like transactions, savings, credit, and insurance at an affordable cost that meets people's needs-delivered in a transparent and sustainable way (see, Cavoli, Onur, and Sourdin, 2020). A growing body of literature has shown the positive impact of financial inclusion on the poverty reduction and improvement of the financial health of poor households in developing countries like India. Financial inclusion requires the access of useful and affordable financial services to the deserving and marginalized people of society. From the very beginning, the need for financial inclusion is recognised by the policymakers in India for the sustainable socio-economic development of the people.

According to Census 2011, out of 246.7 million households, only 142.8 million (58.7%) had access to banking services, only 8 percent had borrowed from formal financial institutions in the past and only a similar number of people were using a debit card (see, Nimbrayan, Tanwar, and Tripathi, 2018). Similarly, the World Bank data for the corresponding period shows that 35 percent of people owned accounts in the banks in the country, while in rural India 33 percent of people owned bank accounts. Females (+15 years) owned 26 percent of accounts in banks comparatively very less than males (+15 years) who owned 44 percent of accounts as shown in table 2 (see, Global Findex, World Bank).

The financial insecurity and income inequalities among the economically weaker sections have been big challenges in their way forward. Policymakers in India observed that sustainable economic growth is not possible unless the people are empowered economically. Acknowledging these facts, the Indian

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government started Pradhan Mantri Jan Dhan Yojana (PMJDY) scheme, aiming to have access to banking services to the unbanked people comprising of poor households by offering zero–balance accounts (see, Pradhan Mantri Jan-Dhan Yojana, GOI). Subsequently, in the direction of E-Governance, the Jan Dhan-Aadhar-Mobile (JAM) scheme was introduced in 2015 with the aim of integrating PMJDY with mobile phone technology through a biometric ID identification for the quick transfer of monetary benefits to the poor in a transparent manner.

As of now, financial inclusion is the demonstrated example of the success of E-Governance implementation in India for digitally linking the marginalized people of society with the banking system. The empirical studies have shown that financial inclusion has helped in reducing poverty in India besides bridging the financial account ownership in terms of gender and income inequalities (see, Ghosh and Vinod, 2017;Churchill and Marisetty,2019; Cavoli, Onur, and Sourdin, 2020). Financial inclusion through digitalization has been successful in empowering the households economically in rural India, the studies have further shown.

Extending the scope of E-Governance, the GOI launched the 'Cashless Campaign' in 2017, aiming to promote cashless transactions in the country. Beneficiaries of financial inclusion in the country have been benefited from this campaign by having direct transfers of payments of their earned wages under the Mahatma Gandhi Employment Rural Guarantee Scheme (MGNREGS) into their bank accounts. Similarly, the direct credit of the payments was started under the micro-insurance schemes aiming to provide insurance coverage to economically weaker sections of the society, and the pension payments under the Swavalmban Yojana-a pension scheme for the workers.

Over the years, financial inclusion through PMJDY has enlarged the scope of E-Governance in the country. As shown in table 2, more than 80 percent of people (+15 years) had bank accounts in 2017, with a significant rise in the ownership of bank accounts in the rural areas (79%) during the same year. Financial inclusion through PMJDY has also bridged the gender gap in accounts ownership in 2017. Females (+15 years) owned 77 percent of bank accounts in 2017, while corresponding numbers for males (+15 years) were 83 percent as reported in table 2. It is also noted that the bank accounts ownership of labour force are also increasing over the years. Table 3 further summarizes the current state of financial inclusion and corresponding benefits in the country as on September 2021. It is observed that the number of bank accounts ownership and bank branches especially in rural areas have expanded over the years to mobilise the small savings of the poor people.

Table 2. Bank accounts of Indian households

Year	Account, male (% age 15+)	Account, in labour force (% age 15+)	Account, female (% age 15+)	Account, income, poorest 40% (% ages 15+)	Account, income, richest 60% (% ages 15+)	Account, rural (% age 15+)
2011	44%	44%	26%	27%	41%	33%
2014	63%	64%	43%	44%	59%	52%
2017	83%	84%	77%	77%	82%	79%
Source: Global Findex database, World Bank						

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Table 3. Beneficiaries of financial inclusion as of September 29, 2021

Bank Type	Number of Beneficiaries at rural/semi-urban centre bank branches (in million)	Number of Beneficiaries at urban metro centre bank branches(in million)	No Of Rural-Urban Female Beneficiaries(in million)	Number of Total Beneficiaries(in million)	Deposits in Accounts(in USD, billion)
Public Sector Banks	214.21	129.10	189.20	343.30	15.31
Regional Rural Banks	6.9.21	9.80	45.70	79.00	3.8.2
Private Sector Banks	7.01	5.70	7.00	12.70	0.58
Grand Total	290.43	144.60	241.90	435.0	19.71
Notes: Deposits are converted into USD at an average exchange rate of INR73.74/USD Source: Pradhan Mantri Jan-Dhan Yojana, Ministry of Finance, GOI					

E-GOVERNANCE AND DIRECT BENEFIT TRANSFER

To check the potential leakages in the benefits directed to the marginalized and economically weaker sections remain an all-time high challenge for the policymakers in developing countries due to large scale corruption in public organisations. Among the others, leakages in the cash and non-cash benefits aiming for the socio-economic development of the marginalized people due to the corruption in government agencies, and the technological divide between rural and urban India have been the prime causes for not reaching the full benefits of various government-sponsored welfare schemes to the entitled beneficiaries. Now Information and Technology (ICT) based direct benefit transfer (DBT) system provides direct credit of cash benefits into the identified bank accounts of entitled beneficiaries under the different welfare schemes. This system has offered quick and equitable transfer of cash and non-cash benefits in a transparent manner while ensuring the check on the leakages and unavoidable delays in decision making owing to the multilevel hierarchy of administration.

The data shows that 1.5 to 2 trillion USD per year is paid globally in the form of bribes which amounts the 2 percent of the worldwide gross domestic product (GDP) (see, Lagarde, 2016). The developed and advanced countries also witness corruption on a large scale. For example, the study of Achim et. al (2018) reveals that 19 percent of European countries' GDP is lost in the shadow economy. Highlighting the large scale leakages in the benefits and corruption in the distribution agencies responsible for delivering welfare programmes in India, former Indian Prime Minister Rajiv Gandhi once said during a public address in 1985, that only fifteen paise (cent) of every rupee spent for the welfare reaches to entitled beneficiaries (see, Hindustan Times). The empirical results of 70 countries show that ICT adoption impact in reducing corruption are statistically significant but not too substantial. The findings suggest that ICT potential has yet to be fully realized in reducing corruption (see, Lio, Liu, and Ou, 2011).

Acknowledging these facts, the GOI started the direct benefit transfer (DBT) scheme in January 2013, leading to direct transfers of cash into the bank accounts of the entitled beneficiaries under various welfare schemes as a part of extending the E-Governance system. After observing the visible gains

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in curtailing the leakages into the benefits, DBT has been expanded across the country, in which more and more schemes are brought under the coverage in different phases. As of now, DBT provides the direct benefits transfer in 311 different welfare schemes under the 54 ministries of the GOI (see, Direct Benefit Transfer, GOI).

For the effective check on fake accounts, unwanted delays and other malpractices, the bank accounts of beneficiaries are seeded with Adhaar numbers for DBT benefits. Adhaar is a unique identification number that is generated based on the individual's biometric and demographic data. The GOI uses the Public Financial Management System (PFMS) which comes to be a robust digital payments technology for all types of direct credits into the bank accounts of entitled beneficiaries. The DBT has the potential to become a viable system for social security and a special income support programme in India for ensuring a threshold level of income for all economic weaker sections (see, Saini et. al, 2017).

Further, it is recommended the replacement of the existing system of subsidized distribution of food grains under the Public Distribution System (PDS) with the ICT based DBT system involving the direct credit of cash benefits into the bank accounts of beneficiaries rather than the physical distribution of food grains. The DBT in addition of other governance reforms has led to the reduction of leakages in subsidies and other cash disbursements under welfare programmes resulting in the removal of duplicate/ fake beneficiaries. As a result, the government has been successful in targeting genuine and deserving beneficiaries.

Just in a span of a few years, DBT has proved a successful tool of E-Governance, wherein the GOI has identified a unique way out by using ICT enabled solutions in reaching to the deserving needy people of society. Now ICT enabled DBT system has identified a large number of ghost (fake) beneficiaries. As per the report, a large number of duplicate/non-existent/ineligible beneficiaries are removed from the list of eligible beneficiaries due to ICT enabled Adhaar seeded bank accounts (see, Direct Benefit Transfer, GOI).

A few examples among the others are: (1) 44.9 million duplicate, fake/non-existent consumers of Liquefied Petroleum Gas (LPG) are removed for subsidized gas connections under the PAHAL scheme of the Petroleum & Natural Gas ministry. (2) Food & Public Distribution Department has removed the 29.8 million Ration Cards (including some due to migration, death etc.) from the beneficiaries list of the subsidised food distribution. (3) For the MGNREGS scheme, Rural Development Ministry has estimated 10 percent savings in wage payments on account of the deletion of fake beneficiaries from the eligible list. (4) For the NSAP scheme, Rural Development Ministry has removed the 0.75 million beneficiaries (including some due to migration, death etc.) from the eligible list. (5) Ministry of Minority Affairs for the different Scholarship Schemes has removed the 0.53 million non-eligible/ non-existent people from the eligible beneficiaries. (6) Ministry of Social Justice & Empowerment for different Scholarship Schemes has removed the 0.19 million duplicate, fake/non-existent beneficiaries. (7) Ministry of Women and Child Development has removed the 0.98 million fake beneficiaries from the Aanganwadi Services which is designed for the distribution of food items as Supplementary Nutrition to the children. (8) While providing Fertilizer Subsidy, the Department of Fertilizers, has reported a reduction of 12.08 million Metric Tonnes of fertilizer sale due to the removal of fake/non-eligible beneficiaries.

These are the demonstrated examples, wherein the GOI has successfully curtailed the leakages in the cash benefits directing to the weaker sections. Further, Table 4 summarizes the estimated gains/benefits to the government due to the adoption of ICT enabled E-Governance in implementing various welfare schemes. It is noted that the government has saved the leakages of USD 13.87 billion up to March 2018 due to the implementation of ICT enabled E-Governance. During the pandemic 2019-20 caused by

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Coronavirus 2019 (COVID-19) potential leakages of USD 5.15 billion are saved through the deletion of fake/non-existent beneficiaries.

Up to March 2018 so far, PAHAL is the single largest scheme where GOI has saved the leakages of USD 6.51 billion due to digitalization of LPG gas connections, subsequently, leakages have further reduced by USD 2.53 billion during April 2018-March 2019, and USD 1.64 billion during April 2019-March 2020 respectively. Under the PAHAL welfare scheme, the LPG gas cylinders are sold at market rate to the households, and subsequently, the cash subsidies is directly credited into the Adhaar seeded bank accounts of entitled/deserving beneficiaries. The PAHAL scheme was launched in 2013 and modified in 2015, leading to reducing or diversion in leakages and elimination of duplicate or bogus LPG connections.

Similarly, Public Distribution System (PDS) which is the world largest food security programme comes to be the second saver of the leakage of subsidies/food grains which are distributed to the people living below to the poverty line. Under the PDS, each poor family is provided 20 kilograms of food grains at highly subsidised prices, leading to the benefits of more than 60 million poor households. The identification of the beneficiaries is done by the respective state governments on the basis of state-wise poverty estimates as provided by the Planning Commission now renamed as NITI Aayog, GOI. Due to Adhaar based identification of targeted beneficiaries, GOI has saved leakages of USD4.57 billion up to March 2018 in PDS, subsequently USD 2.71 billion for the period April 2019-March 202o.

Similarly, the MGNRES scheme of the Ministry of Rural Development, GOI, is responsible for providing at least one hundred days of guaranteed wage employment in a financial year to every unskilled member from households in the rural areas for ensuring their livelihoods. The scheme also mandates that at least one-third of the workforce should be women, ensuring equal payment of wages as to their male counterparts. It is found that women participation in many states is more than the males, especially in Southern Indian states where female participation comes to be more than the national average of 48 percent (see, Vij, 2011). During the current Financial Year 2020-21, more than 82.9 million beneficiaries have been provided employment under the MGNRES (Direct Benefit Transfer, GOI).

The unwanted Administrative intervention and delay in wage payments were found common issues among the others, in implementing and getting desired outcomes from MGNRES in the earlier phase (Narayanan, 2017). Now due to the direct transfer of wages into the Adhaar seeded bank accounts of entitled beneficiaries, the government has prevented the leakage of USD2.47 billion up to March 2018, besides curtailing the administrative interventions. Among the others, the welfare schemes like Scholarships to the minorities and other deserving students, Subsidies directed to farmers, were also sources of huge leakage due to Non-existent/Fake beneficiaries as shown in Table 4. Now, due to digitalization, GOI has been successfully targeting genuine beneficiaries (see, Direct Benefit Transfer, GOI).

In addition, ICT based governance system also offers a robust check on financial and economic crimes to developing countries like India. For example, the data of 185 countries show that increased use of ICT-based governance systems reduces the size of corruption such as tax avoidance, a different form of financial and economic fraud (see, Achim, Borlea and Văidean, 2021). Similarly, the use of ICT has the potential to reduce poverty by improving its access in education, health, government, and financial services to marginalized people. However, a digital divide between rich and poor is one of the biggest challenges in developing countries. To overcome this problem, low-cost access to digital infrastructure is a necessary prerequisite for the successful use of ICT by the poor (see, Cecchini and Scott 2003). Further, the technology adoption in public e-procurement has a positive and significant relationship in developing countries in reducing corruption in public procurement schemes (see, Neupane, Soar and Vaidya, 2012).

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Table 4. Estimated benefits from DBT and other governance reforms (in million, USD)

Ministry/ Department	Name of Scheme	Cumulative upto March 2018	April 2018- March 2019	April 2019-March 2020
Petroleum & Natural Gas	PAHAL	6513.86	2531.64	1643.53
Food & Public Distribution	PDS	4577.51	2619.46	2705.59
Rural Development	MGNREGS	2476.57	689.38	685.66
	NSAP	67.58	11.31	1.17
Minority Affairs	Scholarship Schemes	24.52	0.000	121.21
Social Justice & Empowerment	Scholarship Schemes	36.71	14.21	0.14
Women and Child Development	Supplementary Nutrition Program	-	222.67	0
Department of Fertilizers	Fertilizer Subsidy	-	1461.35	0
Others	Others	172.68	-	0
		13,869.44	7550.03	5157.30

Notes: All the values are given in Indian Rupee (INR), are converted into USD for the ease of comparison.
For Cumulative up to March 2018, the average exchange rate of INR64.9/USD is used.
For April 2018 to March 2019, the average exchange rate of INR68.43/USD is used.
For March 2019 to April 2020, the average exchange rate of INR71.20/USD is used.
Source: Direct transfer benefit, GOI.

How E-Governance Proved as a Blessing During the Pandemic

In India, the ICT enabled DBT system has proved a blessing for poor households during the pandemic. It was the real-time test of the Indian E-Governance system in protecting the livelihoods of the poor. The outbreak of the COVID-19 pandemic has posed far-reaching socio-economic consequences, especially for developing countries like India. The disease which was originated from the Wuhan province of China spread all over the world within the span of two months. India being one of the most populous countries has been expected to be the hardest hit country owing to its high population density.

For the effective containment of the pandemic, the health experts suggested mass testing for early detection, strictly isolation of infected cases, contact tracing and practising social distancing as the viable strategy. Acknowledging the health crisis, India imposed a strict nationwide lockdown in the first week of March 2020 for 21 days, which was extended the further number of times. The national lockdown involved the suspension of all sorts of economic activities, shutting down of educational institutions, commercial complexes and worship places. The daily wage earners, migrant workers and poor households were badly affected due to the suspension of all commercial activities.

The pandemic left no choice for the government but to choose the saving of lives over the livelihoods as the viable strategy to flatten the infection curve in the initial stage of the pandemic. The longer and more extensive lockdown had plunged the Indian economy into a deep recession. Millions of people lost their jobs, others like shopkeepers, small businessmen, contractors, rickshaw pullers, labourers etc. experienced zero income due to nationwide lockdown. Altogether, their lives and livelihood were under threat, having not sufficient rations and other necessary commodities (see, Kumar, 2021).

During the pandemic, E-Governance driven DBT using the PFMS technology has facilitated direct cash transfers into the identified bank accounts of entitled beneficiaries and marginalized people. The

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cash amounts of USD 3649.21 million were directly transferred into the bank accounts of 114.20 million entitled beneficiaries for both Central and Central government-sponsored welfare schemes (see, Press Information Bureau, GOI). Table 5 summarizes the number of beneficiaries and cash amount which was directly transferred into the bank accounts of beneficiaries under the different welfare schemes to protect the livelihood of poor households during the pandemic. In addition, the GOI has also done the direct cash payments of INR 500 (equal to USD 6.64) into the Jan-Dhan Accounts of women from economic weaker sections.

During the pandemic, all the Indian State governments have also used the DBT system for transferring the direct cash into the Adhaar seeded bank accounts of economically weaker people under the state-sponsored welfare schemes. For this purpose, an amount of USD 1240.69 million was transferred into the accounts of 45.90 million beneficiaries under the 180 state-sponsored welfare schemes from March, 24, 2020 to April, 17, 2020. Table 5 summarises the welfare schemes under the different ministries of the GOI, aiming to the welfare of marginalized people, highlighting the amount which was transferred during the pandemic period along with the number of entitled beneficiaries. The original data is in INR which is converted into USD at an average exchange rate (USD/INR) for the ease of comparisons (see, Press Information Bureau, GOI).

It is noted that the welfare schemes like Pradhan Mantri Kisan Samman Nidhi Scheme (PM-Kisan), MGNREGS and Indira Gandhi National Old Age Pension Scheme (IGNOAPS) have attracted the largest direct transfer of cash benefits into the accounts of entitled beneficiaries during the pandemic. PM-Kisan is a welfare scheme fully sponsored by Central Government, aiming to provide direct transfers of up to INR 6000 (USD 83) annually as minimum income support to the farmers. This scheme aims to cover 125 million marginalized farmers across the country.

The IGNOAPS is implemented as a part of the National Social Assistant Programme (NSAP), is a welfare scheme that aims to provide social protection to the eligible beneficiaries from poor households. Beneficiaries under the IGNOAPS provides the direct cash benefits of INR 200 to senior citizens between 60-79 years of age, and INR 500 to 80 years and above of age. The National Social Assistance Programme (NSAP) provides social assistance benefits to poor households such as old age people, widows and disabled people.

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Table 5. DBT transfer during pandemic (March 24, 2020- April 17, 2020)

Name of Scheme	No. of beneficiaries (in million)	Amount transferred (in million, USD)
Pradhan Mantri Kisan Samman Nidhi (PM-Kisan)	84.38	2358.18
Mahatma Gandhi National Rural Employment Gurantee Scheme (MGNREGS)	15.57	718.89
Indira Gandhi National Old Age Pension Scheme (IGNOAPS)	9.32	132.91
Indira Gandhi National Widow Pension Scheme(IGNWPS)	1.24	21.09
National Rural Health Mission	1.10	37.34
Pradhan MantriMatruVandanaYojna	0.76	27.86
Pre Matric Scholarship for Minorities	0.57	21.26
Food Subsidy for Decentralized Procurement of Foodgrains under (NFSA)	0.29	2.55
Indira Gandhi National Disability Pension Scheme(IGNDPS)	0.24	3.58
National Social Assistance Programme (NSAP)	0.22	4.06
Notes: All the values were given in Indian Rupee, are converted into USD for the ease of comparison. Average exchange rate of INR/USD: 75.20/1 is used in converting Indian Rupee amount into USD Source: Press Information Bureau (PIB), GOI.		

CONCLUSION

Being a welfare state, the successive governments have started a large number of welfare programmes for the socio-economic development of marginalized people since independence. Policymakers were quite sure about the fact that sustainable economic growth could not be achieved unless it is inclusive. For this purpose, the economic benefits should be reached to the poor people for their socio-economic upliftment. However, after 74 years of independence, a visible socio-economic disparity exists between the different sections of Indian society. The economic development which has taken place in the last decades is largely confined to the urban centres. In India, a measurable rural-urban divide can be observed in existing social and physical infrastructure, and in the overall economic well-being of the people. People in rural areas are still struggling for quality education, good health care, and other ICT based services.

Due to the huge population size, the information asymmetries in the domain of the general public tend to create obstacles between people and agencies overseeing the disbursement of subsidies and other monetary transfers, giving rise to the possibility of leakage. In order to achieve high economic growth, the need for E-Governance is felt stronger than ever before to reach the benefits in a transparent manner to the marginalized section at a faster rate. There are certain sections in society that feel discriminated on the basis of caste, religion, ethnicity and location by the others who find themself in comfortable positions. The existing welfare schemes can be transformative if they integrate the marginalized people into the mainstream of development by empowering them economically. A sustainable high economic growth is not possible unless it is inclusive. In recent years, E-Governance based on ICT has transformed the implementation of welfare programmes in targeting and reaching equitable benefits to the entitled beneficiaries in a transparent manner.

The direct payments into the bank accounts of entitled beneficiaries have curtailed the leakages and corruption in government agencies involved in the implementation of welfare programmes. Now poor people are getting the direct payments of their wages of employment-based schemes, and other cash

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benefits into their Adhaar seeded bank accounts, leading them to think to be part of the development process. The schemes like MGNREGS and PMJDY have benefited the downtrodden people, especially the women in the rural areas through their wider participation in employment and household financial matters. However, the poor state of digital literacy especially in women in rural areas is a matter of great concern. It clearly highlights the need for the development of digital infrastructure in rural areas for better connectivity, in addition to the building of digital skillsets amongst people, to be able to reach them through E-Governance.

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Section 3

Investigating the “What” in Digital Transformation

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Chapter 14
Action-Oriented Framework for User-Driven Technology Innovation:
A Co-Creation Perspective

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ABSTRACT

User involvement is crucial for designing technological products with "real-world potential" in the digital transformation realm. The existing tacit consensus on user-driven innovation suggests users' proactive role in information sharing and rather a passive role of firms restricted mainly by users' information receiving. However, the importance of translating users' information into concrete technological product features and integrating new users' knowledge in the product development process is salient for firms. The present research theoretically derives the action-oriented framework based on the adapted linear communication model and empirically tests it in the context of technological product development within a startup. The study contributes to innovation management literature and co-creation research stream by enlarging understanding of the role of a firm in user-driven innovation. Furthermore, the study provides the action-oriented framework "listen-think-do" that enables the transformation of valuable users' information into firms' actions and new product development.

INTRODUCTION

Digital transformation (DT) is identified as one of the major phenomena changing society and business in the near and long term future (Kraus et al., 2022; Parviainen, Tihinen, Kääriäinen, & Teppola, 2017). DT promises to transform how organizations operate and deliver value for customers (Kraus et al., 2022; Vial, 2019). In particular, DT deepened the new level of customer involvement in the innovation process (Kraus et al., 2022; Gassmann et al., 2010). Accelerated by rapidly evolving digital technologies, DT enables valuable knowledge to be broadly disseminated and easily accessed (Von Hippel; 2005; Barrett

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et al., 2012; Fitzgerald et al., 2014; Parviainen et al., 2017). Moreover, the traditional approach to innovation characterized by the passive or consuming role of users has been changed (Zaitsava et al., 2020). Now the role of users is to be active innovation contributors throughout the whole path of the innovation process (Gobble, 2016; Curley and Salmelin, 2017; Baldassarre et al., 2017). Users are at the very core of the creation of new solutions (Baldassarre et al., 2017). Also, DT is characterized by prompt changing tastes of consumers, new customer expectations, shortening the life span of products, and puzzles to develop successful market solutions with real-world application potentiality (Blank, 2013; Hilbolling et al., 2021). It becomes extremely challenging for organizations to innovate when users' needs are not clear, many technological alternatives exist, and younger and more adaptable competitors step in (Nambisan et al., 2017; Sebastian et al., 2017). The need for managerial approaches that will help to discover and translate users' expectations into well-articulated knowledge is salient (Sebastian et al., 2017).

Specifically, co-creation and user-driven innovation (Von Hippel, 2007; Baldwin and Hippel, 2011; Afonso et al., 2012; Piller and West, 2014; Ramaswamy and Ozcan, 2018) respond to the challenge of developing successful products with a "real-world" potential (Laursen and Salter, 2006; Kohler et al., 2009; Gobble, 2016). In the co-creation paradigm, an organization and its (potential) customers interact to create valuable services, products, or customer-focused benefits (Jain et al., 2021; Ramaswamy and Ozcan, 2018). User-driven innovation is an inseparable part of this process, as it enables meaningful innovation driven by users' needs and insights (Von Hippel, 1976; Baldwin and von Hippel, 2011). Communication and interaction between firms and users to share unique knowledge and continuous and meaningful interactions are especially salient in user-driven innovation (De Moor et al., 2010; Piller and West, 2014; Baldwin and von Hippel, 2011; Roszkowska-Menkes, 2017). The importance of translating users' information into concrete technological product features and integrating it into the product development process cannot be underestimated (De Moor et al., 2010; Von Hippel and Euchner, 2013; Baldassarre et al., 2017).

While users' involvement and sharing of knowledge are crucial for creating successful solutions with real impact (Kohler et al., 2009; Piller and West, 2014), the current user-driven innovation view lacks research on the firms' ability to grasp communicated unique users' knowledge and turn it into effective actions. So far, the existing research on co-creation and user-drive innovation focuses mainly on users' involvement and feedback as such (von Hippel, 2009; Lettl, 2007; Baldassarre et al., 2017; Jain et al., 2021), paying attention to methods for user participation and co-development of new products (Dell'Era and Landoni, 2014). With minor exceptions (Pässilä et al., 2013), this view suggests the proactive and collaborative role of users in information sharing and rather a passive role of firms as information receivers.

To address the gap, the present research theoretically derives the action-oriented user-driven innovation framework based on the adapted Linear Communication model. It empirically tests it in a startup context. The high-tech startup under investigation aimed at employing co-creative practice to inform a new Augmented Reality solution development as the first trials failed. The paper provides an empirically tested action-oriented framework, "*Listen-Think-Do*" for co-creation that enables the transformation of valuable users' information into firms' actions.

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BACKGROUND

Technology Innovation in the Digital Transformation Era

Digital transformation (DT) reflects the integration of a technology into various aspects and operations of a firm that affects how the firm operates and delivers value to its customers (Kraus et al., 2022; McGrath and Maiye, 2010, Vial, 2019). DT should lead to the use of new digital technologies to enable major business improvements (Fitzgerald et al., 2014) to create and get value in new ways (Gobble, 2018). Exemplarily, the emergence, and expansion of smart and connected products and devices facilitated the shift toward product ecosystems, cross-functional teams, and overall force to change the way companies work Porter and Heppelmann, 2015). Scholars agreed on the point that disregarding digital transformation could lead to failure in the highly competitive markets (Parviainen et al., 2015; Kraus et al., 2022), while organizations that successfully design a strategy that integrates internal business processes with external digital technology opportunities will have significant strategic advantages within their specific industry (Loonam et al., 2018).

DT is a highly complex phenomenon that massively relies on emerging technologies and technology innovation (Hess et al., 2016) and, at the same time, challenges firms' technology innovation activities (Parviainen et al., 2017; Jahanmir and Cavadas, 2018). Specifically, with DT becoming a new realm, technology life cycles shorten, and tech products spread faster (Blank, 2013; Hilbolling et al., 2021). Moreover, not only do digital technologies emerge at a very high pace but also they can be "outdated" at a high pace too (Jahanmir and Cavadas, 2018). Moreover, customers' views of product or service innovation have changed. Exemplarily, as with emerging technologies, firms have new potential to develop unique experiences, and tastes and customer expectations change promptly (Kraus et al., 2022). It becomes extremely challenging for organizations to innovate when users' needs are not clear, many technological alternatives exist, and younger and more adaptable competitors step in (Nambisan et al., 2017; Sebastian et al., 2017). All these puzzles to develop successful market solutions with real-world application potentiality (Blank, 2013; Hilbolling et al., 2021) and create products that have a real possibility of being adopted and generate value for users in the long run (Jahanmir and Cavadas, 2018). To effectively manage technology innovation and new digital products that emerge in a highly dynamic environment, firms need to make a shift in value creation where the role of a customer is elevated to a (co)innovator (Porter and Heppelmann, 2015).

User-Driven Innovation: a Co-creation Lens

DT extremely dynamic environment characterized by rapid technological progress, unlimited knowledge sharing, and collaborative innovation with the new active role of users leaves no choice for firms but to adapt to the new realm in order to be sustainable and competitive in the long run (Zaitsava et al., 2020; Kraus et al., 2022). Indeed, businesses pushed by digital technologies are transforming business models and work methods toward more open and collaborative ones (Eaton, 2015). Specifically, open innovation (OI), coined by Chesbrough in 2006 as an innovation process that intentionally and actively regulates information flows across organizational boundaries, has been acknowledged as a new "arena" for all levels of society to interact and co-innovate (Nieto et al., 2007; Cassiman et al., 2009; Cassiman et al., 2010; Rayna and Striukova, 2015). OI, accelerated by rapidly evolving digital technologies, enables valuable knowledge to be broadly disseminated and easily accessed (von Hippel; 2005; Barrett et al.,

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2012; Yoo, 2012; Fitzgerald et al., 2014; Parviainen et al., 2017). DT deepened the new level of customer involvement in the innovation process (Gassmann et al., 2010). The traditional approach to innovation characterized by the passive or consuming role of users has been changed (Rayna and Striukova, 2015; Zaitsava et al., 2020) now, the role of users is the active innovation contributor throughout the whole path of the innovation process to enable innovation value (Gobble, 2016; Curley and Salmelin, 2017; Baldassarre et al., 2017). Innovation in the OI paradigm is no longer a linear process from a producer to a user, but it happens on multiple levels (Obal, 2013; Bogers et al., 2016). Users are at the very core of the creation of new solutions (Baldassarre et al., 2017).

Indeed, OI, introducing the notion of co-creation and user-driven innovation (Von Hippel, 2007; Baldwin and Hippel, 2011; Afonso et al., 2012; Piller and West, 2014; Ramaswamy and Ozcan, 2018) gave a response to the challenge to develop successful products with a "real-world" potential (Laursen and Salter, 2006; Kohler et al., 2009; Gobble, 2016). Thus, co-creation has been anchored with multiple diverse activities, name a few, co-production, co-development, or presumption (e.g., Ramirez, 1999; Xie et al., 2008; Ramaswamy and Ozcan, 2018). However, the recent study of Ramaswamy and Ozcan (2018) highlights co-creation cannot be explicitly explained through the lens of the growing number of activities with the prefix "co"; unlike those activities, co-creation is more nuanced and it has at its core "creation through interactions". Thus, in the co-creation paradigm, an organization and its (potential) customers interact to create valuable services and products and a customer is a co-creator in this process. In this way, the final product will deliver customer-focused benefits (Jain et al., 2021; Ramaswamy and Ozcan, 2018; Vargo and Lusch, 2008). Indeed, co-creation relies on collaboration and interactions with users as innovators (e.g., Bogers et al., 2010, Von Hippel, 2005; Ramaswamy and Ozcan (2018) to design and develop new and more customized to the users' needs products and services (e.g., Franke and Piller, 2004; Mahr et al., 2014).

In this way, user-driven innovation or innovation that is guided by users' needs and insights coming from the interaction and collaboration with users (Von Hippel, 1976; Baldwin and von Hippel, 2011) became an especially prominent research stream within innovation management and co-creation research (Ramaswamy and Ozcan, 2018). The understanding of the usefulness of user-driven innovation is based on three fundamental premises: users possess unique knowledge about their needs; if possible, users will create solutions to address their needs; finally, users tend to share solutions with others (Piller and West, 2014). Grasping users' information about their preferences and needs is a requirement for successful new product development (Piller and Walcher, 2006). In this respect, due to the collaborative and co-creative nature, rapid communication and interaction are one of the most critical conditions for user-driven innovation (Baldwin and von Hippel, 2011; Roszkowska-Menkes, 2017). Indeed, many scholars have proposed that customer interaction is strictly associated with new product success (Gassmann et al., 2010; Laursen and Salter, 2006; Spithoven et al., 2010) and is crucial for successful products design with "real-world potential" (Kohler et al., 2009). The importance of interaction that leads to active actions within the user-driven innovation concept is highlighted (Bogers et al., 2016). At the same time, De Moor et al. (2010) suggested that among the most important challenges of user-driven innovation for technological products are, firstly, the challenge of the quality of interactions between users and the firm that should be continuous and meaningful. Secondly, the challenge of transforming new users' knowledge and insights into concrete technological features. Indeed, the existing study by Baldassarre et al. (2017) suggests that a firm needs not only to receive information from users but also to reflect on the possible solutions and test them to get iterative feedback from users are critical components of user-

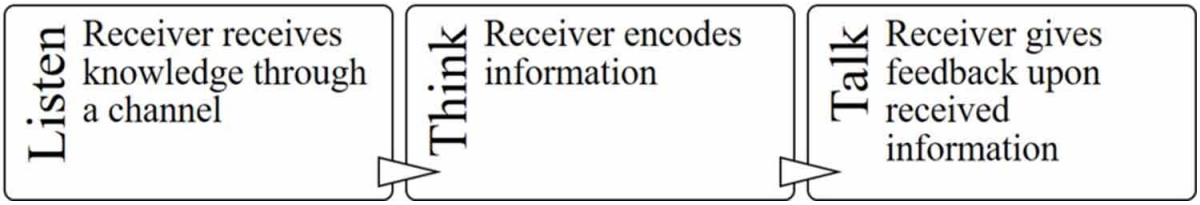
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driven innovation for firms as part of the communication process. However, the need for frameworks that enable grasping users' information and transforming it into actions is salient.

Linear Communication Framework for User-Driven Innovation

This paper adopts the Liner Communication model to propose user-driven innovation for firms willing to communicate with users and to effectively incorporate users' information to innovate and create a new (digital) product. Within this model, also called the Shannon-Weaver model, the logic "sender-receiver" represents well the outside-in knowledge path when the firm needs to receive correct information from a user to innovate (Shannon, 1949). The model focuses on the source of communication (*i.e.*, the user) and is one of the most applicable across businesses to assist communication-driven activities with customers, such as marketing or sales (Chandler, 2014; Stanford, 2014). The process of communication is performed as the flow of information, which goes from the sender who encodes information through a channel (in the original model, it was a phone nowadays, the channel can be anything) to the receiver who decodes the information and gives feedback based on the uncoded information (Shannon, 1949; Velentzas and Broni, 2014). Thus, the model represents the simple path for a firm, firstly, listening, then thinking, and finally, talking back (Figure 1).

Figure 1. Model "Listen-Think-Talk" for a receiver in the Linear Communication model. Based on Shannon (1949)

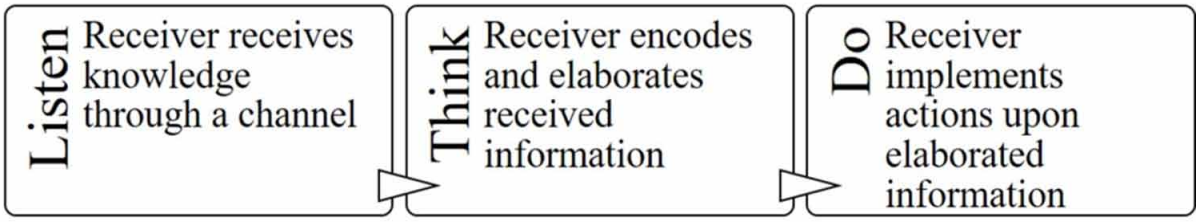


The logic presupposes the information encoding phase only after the information is received, excluding the moment to intervene with new information that a sender did not communicate. Hence, not only the Linear Communication model is straightforward, but also it presupposes role-defined and step-wise communication from a sender to receiver and back but no simultaneous interaction. The model has the core aim to transmit the information as accurately and straightforwardly as possible (Velentzas and Broni, 2014).

Taking as the base Linear Communication model for a receiver role, the author changed the last construct, the "Talk" to the "Do" component and conceptually constructed the Listen-Think-Do (LTD) action-oriented framework for firms that implement user-driven innovation (Figure 2).

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Figure 2. Listen-Think-Do action-oriented framework for firms in user-driven innovation



Where the "Listen" is to receive information from users, the "Think" is to elaborate on the new information, and the "Do" is to implement actions based on the received and elaborated information in the context of user-driven innovation.

METHOD AND DATA

Setting

The research explores the case of a startup that was interested in employing user-driven innovation to drive the development of a new product. For the moment of studying, YaaR was the young (idea level) Italian startup that specializes in Augmented Reality (AR) technology for E-commerce, furniture producers, and marketing agencies. The startup had four co-founders responsible for Development, Marketing, Finance, and Legal Issues. YaaR was taking part in the Contamination Lab (CLab) in Cagliari. CLab – accelerator and startup school for five months. During this time, a startup had to move from the ideation to the successful Minimum Viable Product[1] (MVP) level. This presupposed active product ideation and prototyping as well as fast and radical changes in a product in a time-constraint situation.

Thus, the initial idea YaaR entered the CLab program with was to address a concrete problem of low accessibility of AR technologies on the market. Specifically, unlike all other existing solutions that work with a software development kit, require programmers in a company to implement AR, and can be developed only for native applications on iOS or Android, YaaR was trying to deliver an AR experience, not through apps but enabling AR immediately on web-browsers. Thus, users do not need to download any application to use AR; all they need is to visit the online shop as they did before. In this way, E-commerce does not have to change established processes. Specifically, YaaR performed an initial market analysis and based the idea on the expertise of co-founders in AR technologies and innovative technological solutions development.

The initial idea of user-driven innovation was to find and incorporate necessary technological features into a final MVP that would be presented to investors. However, the first MVP failed. Almost nobody from participants and potential users was willing to buy the YaaR service despite overall enthusiasm about the solution. Therefore, the final goal to employ user-driven innovation was, firstly, to understand what caused the failure while the market research showed that the solution is needed, and second, to develop a new advanced product that will cover the needs of the market.

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The researcher chose the YaaR startup as the co-founders were eager to involve users in new product creation from its beginning. Thus, the author could explore the shift from an idea to a concrete product. Moreover, the startup context makes it possible to run MVPs to test new solutions developed with the LTD framework as they require only rapid prototyping and not a final solution. Finally, the context of the emerging AR technology was especially matching for the research's goal. Thus, AR as a technology has potential on the market, however, solutions that realize AR experience were not yet advanced, thus, leaving a big room for innovation.

Methods

The research aims at exploring the conceptually constructed framework LTD empirically and in the real context. Hence, a qualitative case study was considered the most appropriate method for exploring the contemporary phenomenon in depth (Yin, 2009). This paper used the triangulation principle of data collection and analysis to prevent the research from biased findings (Yin, 2013). Firstly, using ethnographic observations (Sanday,1979; Van Maanen, 1979), the author observed the startup for three months to get the necessary insights and facts to build an empirical evidence base. The author collected data on the two MVPs tests by observing how the startup implements the LTD framework and the implementation of its outcomes (Yin, 2009). To make an evaluation based on the principle "before and after" LTD framework implementation, the author took the in-house developed structure of the first MVP and designed the observation process that includes two steps (behavior observation and an anonymous questionnaire with only three questions to each MVP participant), which are described in Table 1.

Table 1. Two steps of each MVP

Step	Description	Parameters to estimate
1. Behavior observation	Behavioral observation of the participants during the product trials	• Time spent on installation of software • Time spent on AR experience • Additionally - visible satisfaction with the technology usage (non-verbal communication, facial expression, etc.)
2. Anonymous questionnaire	To get an understanding of the users' level of satisfaction with the product questionnaire was taken right after the product trial	Questions to answer: 1. Would you implement AR technology in your sales? 2. Would you recommend the AR technology to your business partners, and colleagues? 3. Would you buy the YaaR service?

Further, semi-structured in-depth interviews (Morris, 2015) were conducted to get insights that cannot be covered by any of the firm's official business documents. The semi-structured open-ended interviews were conducted with four startup experts (co-founders) responsible for the MVP running and strategic decisions within the startup. All participants being students for the interview moment, had already had professional experience and were not beginners in the business sphere (see characteristics of the interview participants in Appendix 1 Table 3).

Two rounds of interviews were taken after the first MVP and after the second MVP to grasp the changes (if any) in the results of the MVPs of four co-founders. The well-structured guide was prepared

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to get answers to all necessary for the research questions (Morris, 2015), while open-ended questions made the interview more flexible and allowed to get comprehensive answers. The interview structure was guided by the research's logic: the personal vision of the market and product followed by the questions on the impression and suggestions on the co-creation session process and results. Finally, respondents were asked to give their assessment of the LTD framework for effectiveness in user-driven innovation initiatives. The interviews were taken in the CLab co-working space in an arranged private area; thus, the environment was friendly and familiar to the participants. The interviews were recorded (four hours and twenty minutes), transcribed, and coded. The coding process was based on the general inductive approach for qualitative data analysis (Thomas, 2006). The author was rigorously and iteratively read interviews to familiarize themselves with the content, define the content topics, and group topics into summaries.

Additionally, internal business documents were gathered and analyzed, such as Business Model Canvas, strategic road maps, and business plan. They gave a deep and broad picture of the business, its advantages, position on the market, and changes in the product after LTD framework implementation.

FINDINGS

Two rounds of MVPs that were focused on testing the market response were analyzed. Moreover, the author analyzed how the startup approached user-driven innovation in practice and included users in the product's features design by employing the LTD framework to inform the second MVP development. The comparative analysis of the market response to the first and second MVP trials is presented.

First MVPs Analysis

For the first MVP, YaaR decided to present to potential clients almost the product's final vision: an application to install on clients' devices, which produces links to use AR on the web, marker-less, which means that there is no need to print some pictures triggering AR. Overall, users' engagement in product creation and design for the first MVP was little or nothing. Co-founders relied only on their market perception and professional background. The main goal was to make the first market validation as soon as possible and to impress potential investors with results. As Expert 3 put it, "*It was a race for investments. Competition insight CLab was high, investors and mentors were aggressive with slashing criticism. They emphasized the importance of showing market interest as soon as possible at each pitch. We were taken in by this idea*".

The first MVP (which took around 30 mins) was a closed process, although participants were in the same room, they were not allowed to interact to not influence each other's point of view (see timing analysis during the first MVP in Appendix 2 Figure 6). All MVP participants were senior managers, the majority of them were owners of their businesses and took strategic decisions about investments in sales and marketing by themselves. As Experts 2 stated, "*We were very careful about target audience choosing. We intentionally invited only decision-making professionals so that they could decide on purchase even right after the trial. But it didn't happen*". As behavioral observation showed, users were nervous and looked annoyed during the installation of AR. At the same time, all participants showed a high level of interest and engagement while trying AR. Also, there were verbally expressed emotions, like "*Wow*", "*Super*", and "*Awesome*". Expert 1 described YaaR's reaction to this as "*We were so happy when we caught this kind of reaction. We thought there were already our clients*".

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After the MVP, all participants were asked three questions, namely, "*Would you implement AR technology in your sales?*", "*Would you recommend AR technology to your business partners, colleagues?*", and "*Would you buy YaaR service?*" (See Appendix 3, Figure 7 for the answers' distribution). Although the general tone of the answers after the first trial was positive, YaaR failed to get a positive answer to the question, "*Would you buy YaaR service*?" from all respondents. Participants showed extremely high interest in the AR technology *per se* and the idea itself but did not want to pay for the solution. "*We literary could not watch to each other's eyes when we understood what happened… it was tough […]"* (Expert 1). As participatory observations showed, the solution was very complex. Thus, while the installation process took more time, the AR experience took less time (see Appendix, Figure 2).

After such contradictory results, when the level of satisfaction and engagement pointed out on the successful market release, but the willingness to buy the technology was zero, YaaR implemented a co-creation session. "*It was the last fight before abandoning our beloved idea*" (Expert 2). According to the deep market research YaaR had conducted, the technology itself was very promising.

"Listen-Think-Do" Framework Empirical Testing

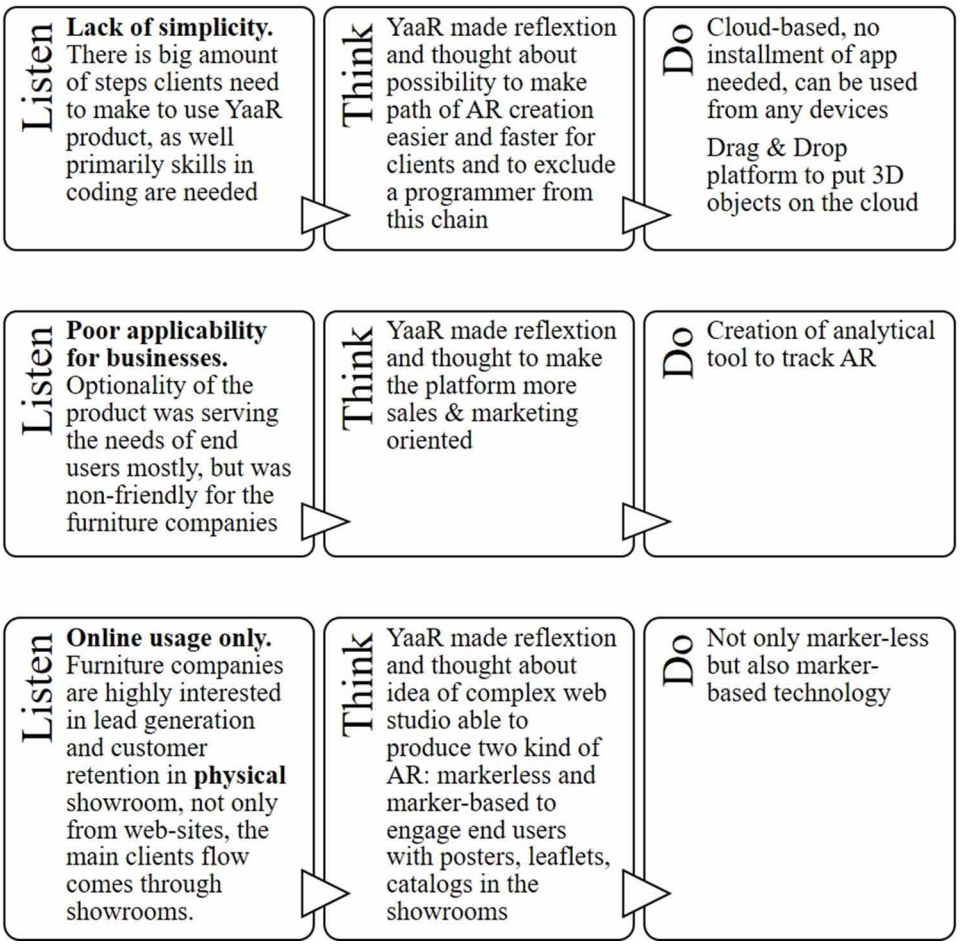
YaaR implemented the three-step LTD framework for service changes. Each step in the framework had its own goal and an expected outcome. The proactive position in listening and taking action on users' insights was the overarching goal of this step.

1. "*Listen"*: the co-creation session to listen to potential users and grasp the main issues they experience with the YaaR solution. The goal is to find the three most significant and concrete issues that restrict the wish to buy a YaaR service. Co-create a map of issues.
2. "*Think*": the iterative process of reflecting on issues to find various solutions. The goal is to find efficient solutions and ways to tackle three issues.
3. "*Do*": rapid prototype design according to proposed solutions. According to the Listen and Think steps, the goal is to implement three main changes in the YaaR service.

The performed framework LTD is reflected in the following steps (see Figure 3).

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Figure 3. Listen-Think-Do framework for YaaR



"Listen." YaaR team gathered the same participants of the first MVP for the co-creation session, where all participants were freely co-creating the advanced version of the product. The decision to implement a co-creation session and not a simple questionnaire or interviews was made to "*boost interaction and real co-creation environment, let professionals share opinions, make loud comments and thus, to get a spontaneous reaction on the service*" (Expert 2). The session lasts four hours. All comments were grouped in general overarching clusters of issues to crystalize and clarify every participant's issues. Therefore, after a deep discussion and critics, the moderator put final generalized points written on the dashboard sticks. "*It was like a verdict. It was very tough to listen to critics of the product you developed so carefully… It was not for the faint-hearted (laugh)"* (Expert 1). Among the variety of issues, three main factors were affecting the usability of the product. Users mentioned them as the crucial drawbacks.

1. Lack of simplicity. There are many steps clients need to make to use the YaaR product, as well primary skills in coding are required.
2. Low applicability for businesses. The optionality of the product was serving the needs of end-users mostly but was non-friendly for the furniture companies

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3. Online use only. Furniture companies are highly interested in lead generation and customer retention in a physical showroom, not only from websites; the main client flow comes through showrooms.

"Think." The next step for the YaaR team was to analyze all notes and comments and reflect on how to change the product to address issues. The reflective process took two weeks, during which the YaaR team was focused on monitoring similar solutions within the E-commerce, marketing, and furniture industries, discussing changes with the developers' team, and adapting them to the existing product. Thus, the first issue, namely, the lack of simplicity, was proposed to address by excluding app install and moving to cloud-based services and, therefore, no installs, setups, and coding skills are needed. The decision to exclude programmers on the users' side was taken. The issue of poor applicability for businesses was addressed by changing service functionality toward corporate needs more and making the solution a more business-oriented platform by including the option of the user account where businesses could track the AR use, such as how many users went through the link, how much time they stayed on a website. The engagement rate was crucial for businesses. YaaR service became not only online-based but also possible to use for offline experiences, such as on collateral materials. In addition, it was expressed the idea of including two types of AR – marker-based and markerless to provide a more comprehensive AR experience and serve special corporate needs. Nevertheless, as Expert 1 said, "*At the beginning,* w*e were sure that markerless technology would strike users, they would love it. But it turned out that they needed a more old-fashioned (marker-based) version with all these printing routines […]. Well […] marker-based […]".*

"Do." A new mockup of the personal user account was developed. The rapid prototype to test two types of AR experience – both online (web-browsers) and offline (printed collaterals, catalogs, leaflets, etc.) was created. The comparative table of the service options before the first MVP and before the second MVP is presented hereafter (Table 2).

Table 2. Comparison of the YaaR service before the first MVP and before the second MVP

	Application-based	Cloud- based	Marker-based	Marker-less	Analytical tool	Automatized
Product before the first MVP	+	-	-	+	-	-
Product before the second MVP	-	+	+	+	+	+

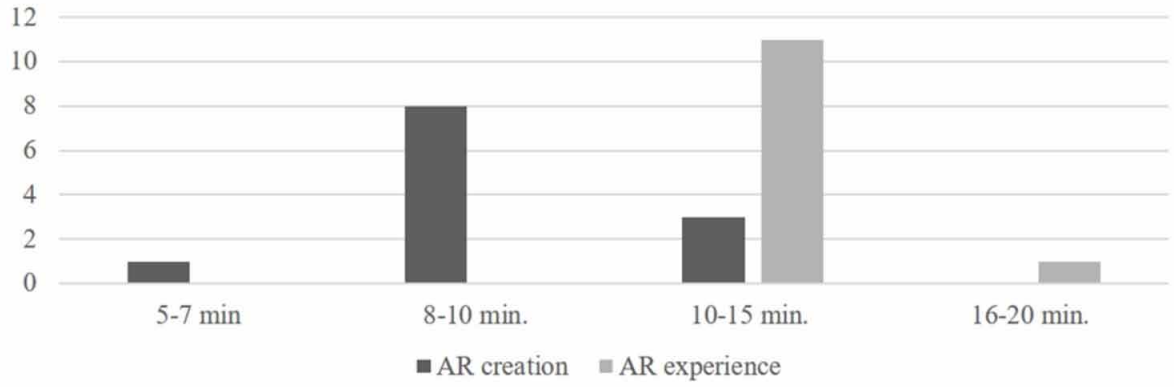
Second MVP Analysis

To estimate the results' effectiveness generated with the use of the LTD framework, the second MVP was held. Participants of the second MVP did not try the YaaR solution before. However, the startup kept the same users' profiles to get feedback from the same target group (see Appendix 4, Table 4 for the comparative profiles of the MVPs' participants). The MVP methodology remained the same: three questions after the trial and time and behavior observation (see answers distribution in Appendix 3 Figure 8).

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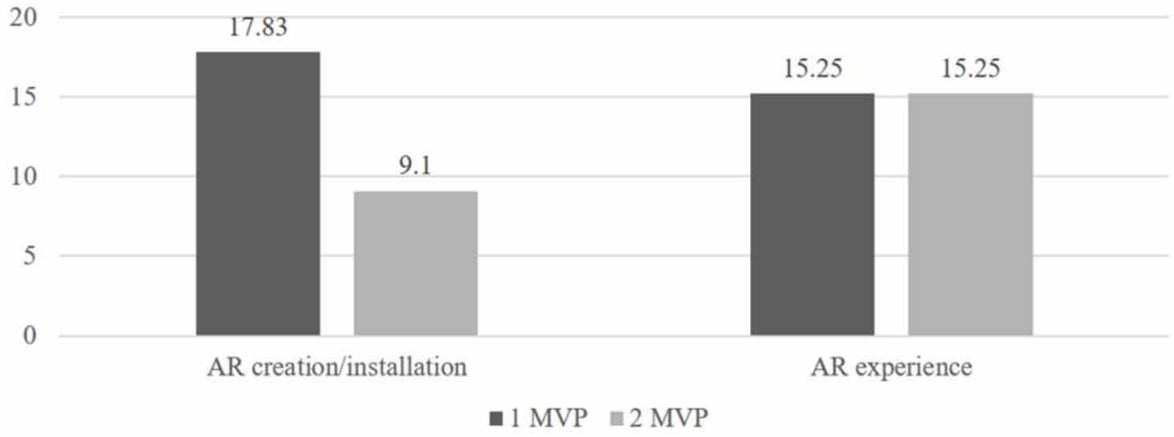
The distribution of answers to the question, *"Would you buy YaaR service?"* completely changed. Now 10 out of 12 gave a positive answer. "*We have got real clients after this MVP. This is what investors were talking about when forcing us to provide market validation firstly*" (Expert 3). Moreover, seven participants claimed interest in signing the contract in the very nearest future. The participants' behavioral trend during the second MVP remained with the same level of interest in the YaaR service, but the time to create AR changed, as shown in Figure 4.

Figure 4. Behavior Observation Report. Second MVP



Eight participants spent around 8-10 minutes, and the other three spent between 10-15 minutes on AR creation (during the first MVP - installation). This can be explained by the friendly user experience provided, as the process of AR creation was automatized, and users could explore AR in more detail without any time-limit pressure. Indeed, the comparative analysis of results on installation (first MVP) and AR creation (second MVP) shows that time spent on AR experience is bigger than preparation time during the second MVP (see Figure 5).

Figure 5. Average time spent on AR creation and experience. Comparison



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The solution created with the use of the LTD framework addressed the main users' issues, and it was driven directly by technology users and edged upon their concrete needs, changing the attitude toward new technology dramatically. As Expert 2 claimed, "*I think that our success wouldn't be possible without the first failure. I even don't want to think, what if we got some clients from the first MVP… Now we would have been dealing with a unique product, but which would have been serving only a very narrow target…"*.

DISCUSSION, MANAGERIAL IMPLICATIONS, AND CONCLUSIONS

The present research explored how a firm grasps unique users' knowledge and insights and transforms them into concrete features of a new technological product within a user-driven innovation paradigm. The author built on the Linear Communication model (Shannon, 1949; Stanford, 2014) and empirically tested in a real setting the "Listen-Think-Do" framework for action-oriented user-driven technology innovation.

Notwithstanding the consensus that users are the main active participants and proactive and collaborative information transmitters in the user-driven innovation paradigm, the researcher argues that a firm's role should not be a passive consumer of ideas driven and shared by users but rather an active processor of these ideas. Moreover, how (actively or passively) a firm processes the ideas influences a final developed technological product. The author found that the processing role of a firm is reflected in three steps, where only the first step, "*Listen,*" can be characterized by the relatively passive involvement of a firm. In our case, at the step "*Listen,*" the firm focuses on receiving information from users about their needs, issues, and information on the new product characteristics. Active involvement of users at this stage is favorable not only to express various opinions but also to group issues, challenges, and needs in large clusters. This aspect helps to proceed with the second step, "*Think,*" which presupposes the active and iterative reflection of a firm on the received information and finding solutions that will meet needs or tackle issues discovered. The third step, "*Do,*" focuses on implementing proposed solutions. A firm implements the step again "*Listen*" to capture whether new solutions are viable for users. Therefore, the whole framework can either be repeated if users' feedback dictates so or only the first step if users' feedback is positive, as in the explored case.

The paper contributes to the DT and co-creation literature in several ways. Firstly, the research breaks the understanding of a firm's role in the user-driven innovation paradigm that has been neglected so far. In line with the existing literature that acknowledges the importance of tech product or service creation through interaction with users (Von Hippel, 2007; Baldwin and Hippel, 2011; Afonso et al., 2012; Piller and West, 2014; Ramaswamy and Ozcan, 2018), the author highlights an essential role of a firm in this interaction process as a vital transformer of users' knowledge into actions. In this way, firms can more effectively address fast-changing users' tastes and needs and the threat of technological products being quickly outdated (Jahanmir and Cavadas, 2018). Second, in line with the research stating that user-driven innovation is crucial for designing products with "real-world potential" (Kohler et al., 2009; Gobble, 2016; Baldassarre et al., 2017), the author also observed that the usefulness and quality of user-driven innovation for new technological product development could be enhanced with the active involvement of a firm in processing users' information and moving beyond the step "*Listen*." Third, the research enlarged an understanding of communication within the user-driven innovation paradigm (Roszkowska-Menkes, 2017) by introducing the firm's notion of action-oriented communication. Specifically, while communication between users and a firm can happen in various directions and at different levels (Obal,

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2013; Bogers et al., 2016), the main communication logic is linear - "sender-receiver." Moreover, there are three main steps that a firm can compress communication with users into, namely, listen, think, do.

The research also provides several managerial implications. Specifically, the action-oriented framework can help to respond to the modern DT challenges in creating technological products with the real-world potentiality and a high chance of being quickly adopted. As co-creation activities are widespread and firms nowadays use co-creation in their everyday business life, the framework focuses on the specific missing part – how to turn users' insights into actions. Firms should be focused not only on grasping unique users' knowledge correctly but also on transforming knowledge into actions. In this respect, not only a firm needs to actively absorb but also elaborate on users' information and insights and transform them into actions that lead to new technological product design, features, and successful innovation.

Moreover, the study may raise firms' awareness of their active role in interaction with users in the user-driven innovation paradigm. Indeed, managers should not be misled by the "user-driven" term when running co-creation sessions with users but take a proactive role in translating new insights, pain points, and needs into actions while listening and giving a floor to users. While still being "user-driven", innovation will also be informed with firm-led insights. Specifically, the step *Think* is a useful practice to elaborate on gained users' insights and align them with a firm's vision. This is crucial when running and informing DT initiatives.

Finally, the action-oriented framework LTD can work as a tool guide and help to set up a clear co-creation strategy with a special role for users in the tech product or service development. Thus, the framework offers an easy and straightforward path to get the most out of interactions with users by following three steps, *Listen, Think, Do*. In this way, the interaction between users and a firm will be linear but action-oriented.

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ENDNOTE

[1] MVP aims at testing a new product that possesses minimum set of features for a business model viability (Ries, 2011; 2017) and users' willingness to pay (Camuffo et al., 2020; Chesbrough and Tucci, 2020).

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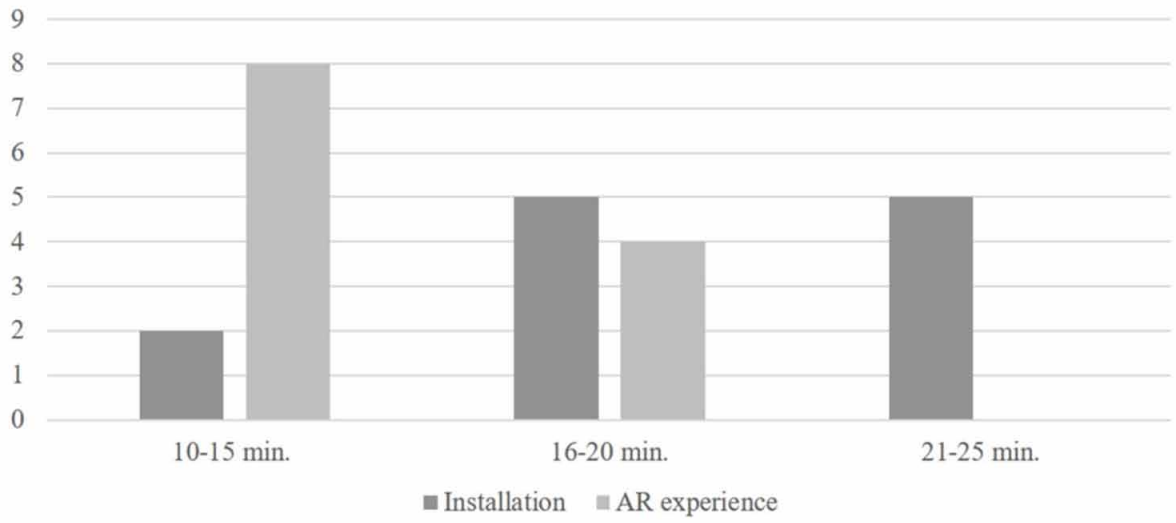
APPENDIX A

Table 3. Experts' characteristics

	Position in YaaR	Responsibilities in YaaR	Working experience (field)	Working experience (years)
Expert 1	Chief Executive Officer	Development of the software Project management Management of the team	Founder of the web development company, management of remotely working devs. Native iOS apps development, project management	5 years
Expert 2	Chief Financial Officer	Financial strategy Pricing Revenue model formation	Accountant in NGO	2 years
Expert 3	Chief Legal Officer	IPR Specifying internal governance policies	Lawyer assistant in family law business agency	2 years

APPENDIX B

Figure 6. Timing analysis. 1 MVP (from behavior observation report).



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APPENDIX C

Figure 7. Responses after the first MVP

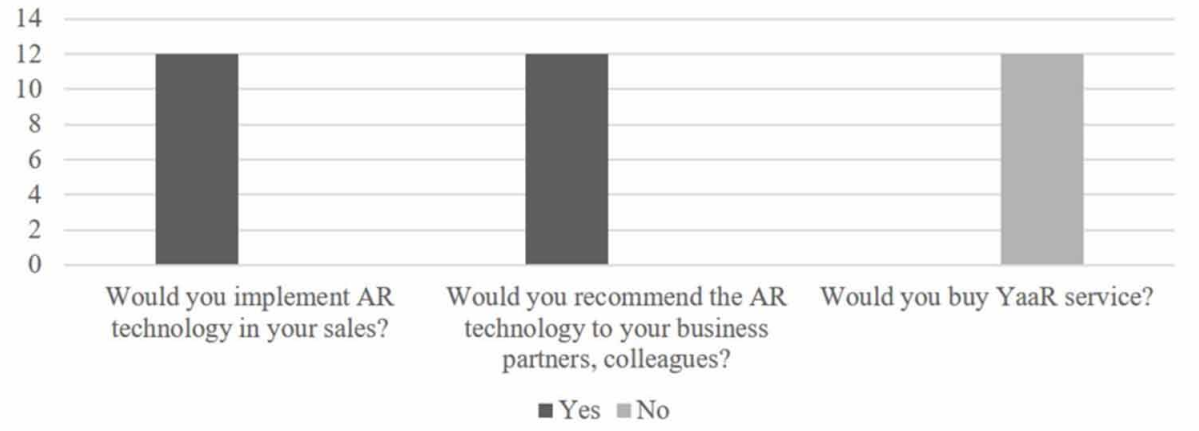
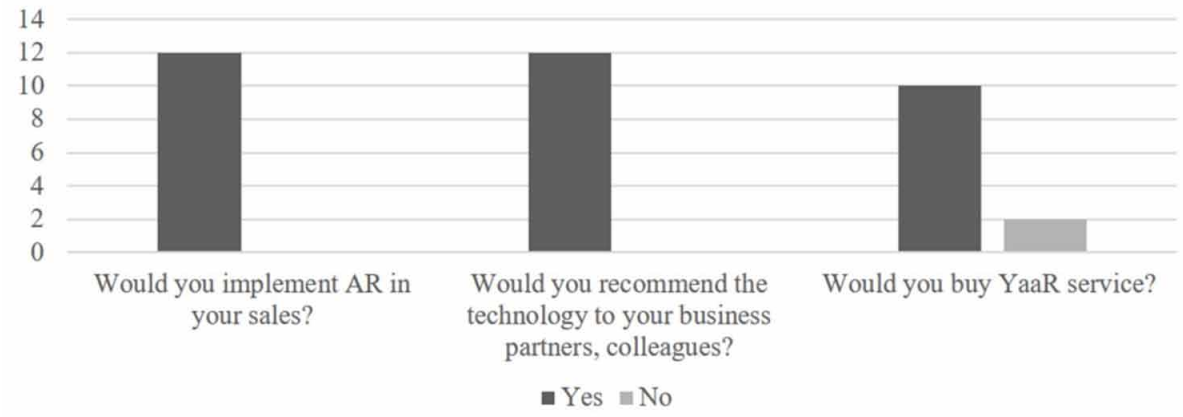


Figure 8. Responses after the second MVP



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APPENDIX D

Table 4. The MVPs participants' comparative profile

	First MVP participants	Second MVP participants
Geography	Italy, Sardinia	Italy, Sardinia
Fields	Furniture reselling	Furniture reselling
Number of employees	10-20	10-20
Position in the company	TOP-management - 4, owner - 8	TOP-management - 3, owner - 9
Responsibilities	Sales and marketing strategy – 9, general management – 3	Sales and marketing strategy – 8, general management – 4

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Chapter 15
Digital Transformations and the Importance of Business Models for Organizations:
Digital Business Models – The Key for Success in Today's Business World

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ABSTRACT

Digital transformation has become a key element for every organization, but in order to succeed, organizations must understand that this will also have an impact on their business model. In the end, what drives success for an organization is their business model, and currently, organizations must be able to innovate and digitalize their business models. This chapter is going to define the main digital business models and how organizations could apply and combine these archetypes and models in order to create hybrid business models or create their own innovative digital business model. The authors are going clarify why digital business models have emerged as a quintessence of innovations in digital technologies. Once an organization understands the connection that it can create using the power of digital technologies, it will be able to survive and thrive in the digital economy.

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INTRODUCTION

Digital transformation is one of the most complex processes which organizations undergo in order to create more value for customers with their products and services and thus gain and retain new customers. Another important aspect of digital transformation is that once started it becomes an ongoing process as organizations must learn and adapt to survive upcoming changes. This requirement for profound and complete organizational change comes from new emerging digital technologies, consumerism mentality that changes from one generation to the other, and trend influence competitive need to gain and maintain competitive advantages (Porter, 2008). The emergence of digital start-ups is another key factor given the fact that they are more flexible than old organizations and can disrupt the market using technologies and digital business models. Considering these facts, many organizations are pressured in adopting new digital technologies to successfully digitally transform into a digital organization and acquire new customers while retaining the existing ones.

Digitization refers to the ability of organizations to transform from an existing analogue infrastructure to a digital infrastructure (Saarikko et al., 2020, apud Tilson, Lyytinen, & Sørensen, 2010). It means that organizations are creating smart products and productions line that can communicate data in real time.

Digitalization refers to the ability of using digital technologies to create value for products and services. It will lead also to change the business model of the organization. And according to Urbach and Röglinger (2019), the client is at the core of digitalization and, consequently businesses must learn to change and adapt their business model according to their customers' needs. While Brown (2020) affirms that for implementing a digitalization an organization must have a clear goal and must ensure that their employees are committed to the new changes that occur inside the organization.

Digital transformation has a broader set of definitions because the term has a high spectrum of coverage and embeds both digitization and digitalization. According to Calp (2020), the digital transformation of an organization is defined as the way they managed to provide better products and services to their customers. Okano et al. (2020) adds that digital transformations is the way in which organizations are able to use technologies in order to create impact and new experiences for its customers. Saarikko et al. (2020) affirms that digital transformation is a sociocultural process and organizations must push their innovation outside their organization border and use all necessary assets and competencies to remain visible on the market. Digital transformation represents the use of digital "…technologies to drive significant improvement on all business segments" (Maheshwari, 2019, pp 17). Herbert (2017) defines digital transformation as the organization "ability to react and successfully utilize new digital technologies and procedures".

The authors propose a new, comprehensive definition of digital transformation based on the definitions of transformation as "a complete change in the appearance or character of something or someone, especially so that thing or person is improved" (Cambridge Business English, 2021), and as "both the action and the effect of transformation", respectively "changing something or someone's form, transmuting something into something else". The authors consider that the digital transformation of an organization consists in transmuting it from a form non-digital, to a digital form, in part or in full. The total digital form of the organization as a result of the digital transformation is an ideal, in our opinion, because it is a moving target, and it is in a permanent state of change. Consequently, the authors define digital transformation of an organization as a strategic process of profound change in scope, both integrally and systematically affecting each component of the organization and the relations between them, executed

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gradually, through step-by-step changes, having a continuous character, without stopping when a final desired form is reached, and aiming for a long-time horizon.

Confronted with the impact of new information and communication technologies that lead to qualitative changes in changing customer needs, the emergence of agile competitors, the proliferation of substitute digital products and services, and with the emergence of new digital competitors on the market, business organizations need to react and adopt digital transformation strategies aimed at maintaining and developing competitive advantages in order to ensure their effective and efficient functioning and ultimately their survival. In line with the organizational model of the 7S (McKinsey, 2008; Peters & Waterman Jr, 2004), changing the strategy by adopting a new strategy, namely the digital transformation strategy to amplify the degree of digitalization of the entire organization will change all other component subsystems of the organization, namely: organizational culture, structure, processes, employees of the organization, their skills and competencies and management style of its managers.

The new digital transformation strategy involves changing the organization's business model by transforming it into a customer value creation model based on new digital technologies, new resources and distinctive skills.

When undergoing digital transformation some organizations are unable to notice that they also must change their business model, mainly because they tend to focus much of their digital transformation drive on technology adaptation and forget that they have to change their business model, too. It is important for organizations to understand how to innovate their business model by trying to define what is the price they can ask from their customers for the products and services they provide, because vision and mission are not about business models. Using this concept, an organization can engage in different strategies and tactics and use digital technologies to generate profits from their product and services and this will become the building blocks of the business. Keays (2020) defines digital business models as "set of tactics deployed to extract the revenue potential of one's information assets, while simultaneously mitigating the costs incurred from the extraction's mechanics and mechanisms" (Keays, 2020, p. 122)

Digital transformation is a very complex process and organizations must be aware that once they succeed, they will experience a revenue increase while reducing the production costs. Companies must transform their core and become more flexible to the market demand. In the digital economy everything is fast changing and market trends that in the past took years to change now they can change every few months or even every month. Given the fact that the global market has become more digital and relies on digital platforms, companies are pushed to digitally transform, to innovate, adopt new digital technologies and change their business model into a digital one. And not only companies are being pushed to digital transform, but also public institutions and non-governmental organizations, too. The Technology Acceptance model is indicating that there are important barriers such as perceived usefulness and perceived ease of use by its users to the implementation of new technologies, including digital ones (Davis, 1989). Also, the learning curve represents another important obstacle towards digital transformation of organizations since the process of acquiring needed digital skills and competencies requires time and monetary resources (Plaza et al., 2010). In addition, the Organizational Maturity models represent an important theoretical and practical approach to the process of digital transformation of organzations. A digital maturity model allows managers and employees of an organization engaging in the process of digital transformation to evaluate the current level and to develop "a clear roadmap for their transformation activities in order to improve the level of digital maturity" (Teichert, 2019, p.1674) . The topic of Organizational Digital Maturity models is quite recent and highly discussed in academic literature, leading to the development of many different variants aimed to conceptualize and assess digital maturity

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in organizations engaged in digital transformation (Ifenthaler & Egloffstein, 2020; Mugge et al., 2020; Gökalp & Martinez, 2021)

While traditional businesses are struggling with digital transformation, new businesses in the digital economy can grow much faster into a global brand because they are already being digital from their inception. These digital companies already have developed a digital business model, and they manage to build their success with the help of a specific mix of digital technologies and digital competencies and therefore this provides them with a unique, distinctive strategic and operational capability to address the key factors of success in their targeted markets. This represents a key strategic aspect in terms of designing the digital business model using the value, rarity, imitability and organized to exploit the model (VRIO) (Barney, 1991). Since digital technologies are accessible to be bought, if a company has the needed financial resources, they will be not filling the rarity requirement, and therefore they will not be distinctive resources. However, being able to use them as a specific mix tailored to the specificities of the company's customers targeted to be served might be a way of overcoming this barrier and thus, becoming a rare mix of digital technologies and of traditional technologies. When expanding the scope of this mix by addressing also other needed resources, mainly rare human resources, the talented people, and their rare competencies to make use and create value for customers by using digital technologies, then such as mix will become not only value creating and a rare capability, but also a capability very hard to be imitated by its competitors. Finally, being able to operationalize this mix of resources and competencies and delivering the expected results in terms of value for customers, profits for shareholders, and benefits for stakeholders, will give that company a distinctive strategic and operational capability compared to their competitors.

The digital economy has changed the ways in which business compete, and digital business can operate in this new market because they managed to develop a digital business model, and these business models differ from traditional business models (Jabłoński & Jabłoński, 2021). This digital business models are based on the digital platform where the participating actors, such as providers, customers are networking and forming entire communities.

BACKGROUND

Business Model Archetypes

In order for organizations to build their business model they can follow on various templates for business models building one such template is described by Jonker and Faber (2021). According to Jonker and Faber (2021), the design process of a business model has three stages. The first is the "definition stage" where the business must define their motives, dreams and value proposition. The second stage is the "design stage" where the organization must understand the business model archetype, create a strategy, define the core activities and involved parties and do an external test of the model, too. The third is the "result stage" where the organization measures its business model and the value created. In the digital economy time becomes critical for organizations when designing and working with business models, and collaborations and networking are key elements when designing a business model. Consequently, value creation is the core of every business model, among other factors that can have a huge influential impact on business model creation. The Business Model Canvas it is a model that already is widely known and used by organizations. However, according to Jonker and Faber (2021) it has a few flows such as the

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time component and is not applicable mainly to digital start-ups and non-profit-organizations. To cover these aspects some alternative business model canvases are used like the 'lean canvas model" or the "circular business "model. But these types of business model canvases according to Jonker and Faber (2021) are not applicable to the digital global economy that has created a more competitive environment for organizations to create and capture value. Also, the business model must have an approach to sustainable economy. Considering these facts, Jonker and Faber (2021) have created a business model template that has four key elements:

- l**ogic of value creation:** organizations must define the value that they create.
- **revenue model:** it defines the profits and benefits that the organizations can obtain based on the value proposition.
- **organization model:** how the organization is managing the value proposition, if it has an organization-centred perspective, loops or networks.
- **Impact:** which defines business model impact on society and environment.

According to Jonker and Faber (2021) for new digital business models to be future proofed must not be organizational-centred but rather inter-organizational centred. In other words, organizations must learn to become more horizontal in their relationships while also maintaining their vertical model. Consequently, it is best for industrial and vertical organizations to develop also a horizontal model with their network that will add better value to their products, since "new business models emerge at the very cutting edge of the horizontal and vertical organization" (Jonker & Faber, 2021, p.29).

But before deciding on a digital business model organization must look at existing types of models. Therefore, the researchers are going to describe in this chapter, first the digital business model archetypes consisting of the "platform model", "community model" and "circular model". These tree digital business model archetypes can be combined into a hybrid digital business model according to organization's specific needs.

The Platform Model Archetype

Partly due to the evolution of the Internet, platform business models are growing in popularity. Platform business models are based on the idea of using a single network, from which users can access different services by paying a fee (Jonker & Faber, 2021). For example, many car sharing platforms connect drivers and users via a smartphone app to a fleet of cars that can be rented for use or shared. The app gives drivers information about the number of available cars and rental charges in the surrounding area. Paying for services is usually done electronically, using credit cards or digital wallets. As such, companies can also collect more data about user behavior and preferences than ever before. This data can then be used to design more effective platforms, which generate increased revenue for both the providers and the users. In addition to this rise in "servitization"—i.e., the development of services delivered via digital platforms—a second trend is emerging: the blockchain technology underlying cryptocurrencies like Bitcoin is making it possible to exchange goods and services securely and transparently without having to use trusted intermediaries such as banks or payment processors (Jonker & Faber, 2021c). Excluding intermediaries allows both providers and customers to capture and share the portion of the added value that was previously captured by intermediaries.

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The Community Model Archetype

Community Business Models are initiatives that combine various actors - public, private and non-profit - to address a specific problem in their community. They can be small-scale or large-scale, short-term, or long-term, but what they all have in common is that they address a pressing local community need. As it has happened with several industries, a trend of decentralization that has been developing in the recent years is changing the way people think. Decentralization means that people are taking responsibility for their own work and environment, whether it's organizing the production of food, or solar panels for electricity. In this process, people become prosumers and therefore no longer solely rely on centralized distribution systems (think of electricity or food, but also mobility). This not only makes it possible to connect people in different ways but also installs community apps with various functions, from lost-and-found to managing local energy grids in a neighbourhood. The community model is based on three key principles which are shared investment, shared returns and multiple value creation (Jonker & Faber, 2021).

Circular Business Model Archetype

The circular business model is a way of extending the value of raw materials, components, and products, such as electronics, lithium batteries, car tyres, bricks, paper, concrete and other building materials, plastic, or glass. The concept of a circular business model can be applied to many different areas of industry and has significant potential in helping to reduce the environmental costs associated with waste management (Jonker & Faber, 2021). As the world becomes increasingly interconnected and advanced, humans find themselves with a growing number of interconnected products and systems that rely on specific materials to function. For instance, modern electronics rely on rare earth elements such as neodymium, lithium, cobalt, and others. These materials are often necessary to produce the most cutting-edge batteries, screens, and other technologies. In the same way that computers can't be used without a power cord or mouse, the smartphones or laptops can't be used without their batteries. The same goes for car tires and glass panes in our windows and doors. Humans can't make buildings out of concrete if they can't find enough components such as steel and copper pipes. Most of these materials are finite resources that exist within naturally occurring cycles of creation and destruction. To preserve our ability to use electronics and other products over an extended period of time, humans must preserve the value that is embedded in their elements. This means keeping them in circulation for as long as possible so they can be recharged, reused, or recycled into new products. The idea behind the circular business model is therefore to design and manufacture raw materials, components, and products in such a way that they can be kept in circulation quasi-indefinitely (Jonker & Faber, 2021).

Choosing the right business model archetype is a critical decision at the start of every business model design process. Several other design decisions will be made later in the process, but they should always be guided by the fundamental choice of the digital business model archetype. The chosen digital business model archetype of an organization determines on which groups your business model will rely upon to fulfill its functions. Combinations of these archetypes are also possible resulting in a hybrid digital business model. For example, it is possible to design a circular material cycle (a recycling company) where customers are also providers (children who bring in their used toys) (Jonker & Faber, 2021).

Although the three business model archetypes seem very different from one another, they share a number of commonalities. All three support the creation of value for two sets of stakeholders: providers

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and customers. All three require a combination of human and non-human capital to be successful. And, finally, all three are built around some sort of circular flow that keeps value circulating through the system.

MAIN FOCUS OF THE CHAPTER

Digital Business

Technology advancement has enabled the emergence and development of digital business that uses different technologies to connect with customers and stakeholders. In a digital business every interaction between different actors is electronic based or electronic induced type of interaction. And the type of pure forms digital businesses in where these actors interact are (Wirtz, 2019):

- e-Education refers to the usage of third parties' platforms by different actors such as teachers and students. This type of platforms helps students learn time-independent and location independent and at their own pace. e-Educations give free or paid access to students to wide pool of different teacher and instructors.
- e-Collaboration refers to the collaborations inside and outside the organizations between actors with the help of digital technologies.
- e-Commerce refers to the transactions done online for the exchange of products and services, while avoiding physical presence in a store.
- e-Communication refers to the usage of different digital technologies either with paid or free subscriptions for communication between teams and individuals.
- e-Information/e-Entertainment refers to the information and entertainment delivered to customers via different third parties' platforms via paid or free subscriptions, another advantage being that the content is an intangible good.

Because digital business models are technology driven can provide rapid benefits for their customers and stakeholders since they enable better services and products. Digital businesses can operate in the digital economy at a worldwide level since they are using the internet together with different platforms to extend their reach in different countries. The Four-Forces Model of digital business show how digital business are able to rapidly grow and what are the key elements that drives this growth (Wirtz, 2019):

- **Convergence and technology**: this force defines how the usage of technology and innovation has help in the diminishing of boundaries between different sectors and activities of value creation. Because it integrates products, services and business it represents the core of making technologically possible business (Wirtz, 2019). This element can be divided in different types: sector level allows organizations to converge with other organizations that have similar sectors; company level refers to the convergent forces of organization in order to repositions itself resulting in modified boundaries; business unit level refers to the convergence of various units inside the organization; and the last one is the convergence of products and services.
- **Digitalization and innovation dynamic:** the second force driving change in the business environment is digitalization and innovation. Digitalization and innovation are the key drivers for changes in the business environment in the Internet economy, as well as for new products and services.

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The increasing pace of technological progress is making it possible to capture, store, and process larger quantities of data. As a result, new forms and possibilities for information processing become available that allow for the development of completely new products, services, and business models. These innovations are made possible by the development of high-speed hardware and software and the increasing use of electronic networks. Companies need to be able to keep up with these changes at a considerable pace, which means they must have a high level of adaptability.

- **Market Complexity:** The Internet has dramatically changed the structure of markets in recent years. In traditional economics, markets are usually characterized by the existence of an information asymmetry between buyers and sellers, which allows sellers to generate a profit by extracting customer surplus through price discrimination. However, with the advances of information technology and Internet technology, this market structure has been fundamentally transformed. The largely free flow of information on the Internet has made it possible for buyers to access more information about products and services and to quickly compare prices, giving rise to a more transparent market. After the rise of the Internet age, marketers have more and more come to realize that customers and users increasingly demand products that they perceive as unique or that are tailored to their individual preferences. Consumers have become less and less willing to accept standardized products. In the marketing world, this phenomenon is known as "fragmentation of markets", a term that refers to the increasing differentiation of customers' demands in terms of price, brand, quality, origin, etc. Fragmentation of markets has had far-reaching implications for marketing, product development and design, which has led to entirely new marketing strategies. Another aspect of the market complexity is that the Internet has created an environment that offers new market opportunities for existing companies but also high risk. The cost of starting up a company and entering an online market has decreased, giving rise to new competitors. As the number of competitors grows, so does the competition intensity, which can lead to price reductions and lower margins. International e-Commerce creates a global market that allows companies to sell their products directly to customers around the world. The incorporation of retailers can be omitted through e-Commerce as well.
- **Customer Empowerment:** As the fourth force, customer empowerment has become a crucial aspect for digital businesses. The Internet and digital technologies have opened new avenues of communication, transparency, and accountability, which has in turn enabled customers to actively participate in production, exchange opinions, and form communities. This has led to an even greater degree of customer empowerment. Thus, companies must not only adapt to this change by providing more transparent forms of production and management but also by creating a more direct business to customer interaction. Also, in the digital economy the customers have the power to switch more easily between brands or products based on prices and information which gives organizations a major challenge and that is decreasing customer loyalty. Customers' empowerment created by digital technologies has given customers the ability to rapidly switch between different barriers such as: technology barriers; qualification-related barriers and psychological barriers (Wirtz, 2019). Thus, customers are paying less for a service of product reducing the revenue of providers.

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"Digital Business to Customer" Model

The "digital business to customer" model is divided into four major segments that are: content, commerce, context, and connection.

The "Content Digital Business" Model

The" content digital business" models consist in the delivery of information provided by different creators with the help of digital platforms. The type of content that is created in it can be categorised in the following categories: e-Information, e-Entertainment, e-Education, and a hybrid category e-Infotainment which is represented by the crossing between e-Information and e-Entertainment (Wirtz, 2019).

For e-Information the value proposition lies in the quality of information provided by the content creator on the digital platform. The most valuable information is one that can help consumers solve a problem that they have or are confronted with. Problem-solving is the key to create value in the e-Information category but also e-Education category. Some content creators focus on niche subject such as politics, society or economics by providing a deeper understanding and information on the subjects. Politicians also like to use the e-Information category within the digital platform to engage with their voters online, spread news about their opinions and achievements. This also gives rise to ethical concerns for the speeding of misinformation's on various topics and aspect of the social life. This is also the category where traditional newspapers have digitalized and innovated their business model. By using their online platforms there can reach more readers with the help of online networks on a global scale. These newspapers offer information on various topic such as politics, economy, and society, and they capture value form customers by providing different price packages. A good platform for e-Information is Pinterest. On Pinterest content creators can promote their blog or website using pins. These pins of the lead users to a website where they can find step by step guides in order to solve a problem. YouTube is also a problem-solving provider it allows content creators to create videos on how to solve specific problems. Users are able to search on these platforms solutions from backing a cake, to fixing a car tire, to garden enhancements.

The e-Education category content creator provides valuable information in a course like format that can be accessed paying a fee or for free, and at the end or the course the customers receive a certificate or diploma that is usually in a digital format. The knowledge gathered by customers is often used in career advancement or the learning of new skills. Some platforms that operate in this category are Udemy and Coursera.

The e-Entertainment category is the use of digital platforms for entertainment, relaxations and passing the time, here a broad range of content can be enlisted from movies to music, to games. The access on e-Entertainment digital platforms can be done via different license fees. Platforms that provide entertainment services are Netflix and Amazon Prime.

The e-Infotainment is a distinct category since it combines e-Information and e-Entertainment aspects, in order to increase their used digital companies often use this combination for the purpose of serving a broader audience (Wirtz, 2019). A platform where content creators can provide both information and entertainment for the audience is YouTube. YouTube allows content creators to also engage in live discussions with their audience, by allowing the audience to ask questions in chat.

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The Commerce Digital Business Model

The "commerce" digital business model refers to transactions done with the help of different digital platforms, and it covers the sales of goods and services. The commerce business model can be categorised by different services with different business model types. The "e-Attraction" digital model refers to the usage of different digital platforms for the advertising products and services, since rising online awareness for organizations has become more and more important in the digital economy. Organizations can create their own advertisement material or hire companies that offer specialize services in online marketing and advertising. This type of content is placed on digital platforms such as Facebook (Meta), Google or TikTok to create engagement with costumers. e-Attraction providers, the players in this space who are responsible for matching sellers and buyers, generate revenue from different models: pay-per-transaction, pay-per-click or as a lump sum (Wirtz, 2019). The "e-Bargaining/e-Negotiation" digital business model comes from using digital platforms to negotiate products and services. While there are goods where the customers are auctioning to obtain a high value product, there are also services where customers have to negotiate the price they are willing to pay for a certain service or product. e-Bargaining/e-Negotiation providers, who seek to facilitate price-based transactions, serve as mediator between customers and merchants. The provider may provide an online platform for negotiating prices or other terms of a transaction and receive an advertising-related or transaction-based commission. A well-known action site is eBay while most digital business prefer to negotiate a price for a certain service with their customer. The "e-Transactions" digital business model offers services for both payment transactions and processing, and the delivery of products. While the payment transactions are handled by platforms such as PayPal, the delivery of products is also externalized to different distributors such as TNT or DHL. And the last category in the commerce digital business mode is e-Tailing which combines all the above digital business models into one model that of retailing. Online digital platforms such as Amazon offer a combination of services to their customers from advertising to money transactions to product delivering. Also, this type of digital business model can be applied in tourism industry on travel sites such as Booking and Expedia where customers can buy travel related services. The core asset of the commerce digital business models is their customers' data, because the analysis of this data provides the business a better inside on customers wants and needs. Using this information organizations can deliver customer tailored advertisement products and services (Wirtz, 2019).

The Context Digital Business Model

The "context" digital business model has three categories: search engines (e-Search), web directories (e-Catalogs) and bookmarking services (e-Bookmarking). Context providers play an important role in the e-Business sector because they do not offer their own content, but rather offer navigational aids that enable users to interact with or purchase the products or services of other companies and organizations. Web portals provide users with a single point of contact (their homepage) through which they can access all types of information, interaction, and transaction offers from various sources. The goal of these organizations is to effectively reduce the complexity involved in searching for information on the Internet by compiling it according to specific criteria so that it can be presented in a context-specific manner. Given the access to large quantities of user data a lot of the revenue for context providers comes from marketing done on this platform by customers and businesses. Core assets for context providers are hardware and software but also the large quantities of data they have access to (Wirtz, 2019). Such context providers

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are search engines like Google or Yahoo!. Web directories or e-Catalogs refer to a listing of people or businesses on the internet. In the past such directories contained links to different websites arranged in categories. An example of web directory or e-Catalogs is Yahoo! Directory. Bookmarking it is often used in today's digital world when a user wants to save and interesting information in order to share with other users, or as personal information to access later. The bookmarking of a webpage can be done via the Internet browser used such as Chrome, Mozilla, or Microsoft Edge. But there are also websites which offer this feature directly allowing users to create their own public or private lists of bookmarks. One such website is Pinterest which allows users to create boards and save their favorite pins.

The Connection Digital Model

The connection digital model refers to the network platforms, and it consist of the social network providers that enable user to stay in touch with friend and family even on long distance. This model is divided into two categories. The "Intra-Connection" refers to the community that uses different digital services like social networks, massager platforms, mailing services, file transfer platforms and so on (Wirtz, 2019). This digital business model provides a commercial service through advertising and connecting people by enabling communication. The interaction on these platforms is driven by its users and most of the services are provided to is users for free since they also promote the advertising of different products and services. This business model also provides the spaces for different influencers to grow their communities, while other use these platforms to create groups and form opinions on different aspects of politics and social life. Since the core of this business model is the people communities it also follows ethical guidelines and censoring inappropriate content. There are a lot of platforms which provide this type of services to their users and some of the biggest platforms are Facebook, Instagram and TikTok. It is important to notice that there are users who have accounts on multiple platforms or even multiple accounts on a platform. As for the influencers and business owners use these platforms for promotion, they often create content to keep their pool of followers engaged with their activities, or to buy their products or services.

The Inter-Connection business model refers to the providers that offer the network infrastructure for fixed or mobile connection. This business model is important because it offers the framework for the digital platforms to run. The services provided often include internet access, telephone, mobile telephone or TV cable. The revenue for this model comes from its customers and is built on different package offers to those customers who pay a monthly fee. The providers in the Inter-Connection business models must face also the challenge of using a technology that is constantly evolving. While the price and speed of their products must be competitive with those of other providers, they cannot afford to lag in technological development. That is because the actual speed of the Internet connection can only be as fast as its network infrastructure allows (Wirtz, 2019). Such services providers are Telekom and Vodafone.

Business to Business Digital Models

While digital business models are more applicable in the business to customer there are also four "business-to- business" digital business models. These digital models focus on the transactions between different organizations. The first two are the "sourcing" model and the "sales" business model. They refer to the transactions that take place between a buyer and a seller, when these transactions are done over the Internet. The third business model is the "supportive collaboration" digital business model,

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and it occurs when organizations do together activities in areas of production, research and development and sale in order to generate value with the help of innovative technologies (Wirtz, 2019). An important asset of this model is the usage of a digital platform for the collaboration network, and in order to create synergetic effect there is a need to create a collaboration of different resources based on the locations need. The fourth type of business-to-business digital model is the "services broker" business model that uses third-party as intermediary for transactions between organizations, and there are no direct connections between organizations. These intermediaries are from "e-Information" and marketplace, they provide information and products and are used as a trading network between different organizations. In other words, organizations gain access to products and services from other businesses through these intermediaries without direct trading their goods and services. These transactions are done inside a digital platform provided by the intermediary or third-party (Wirtz, 2019).

SOLUTIONS AND RECOMMENDATIONS

Given that the above business models represent the pure forms of digital business models, organizations and start-ups can also use hybrid digital business models, which are composed of two or multiple business models. When a business combines different business models, they manage to obtain a decreasing cost per product while increasing the distribution scale. Businesses that develop hybrid digital business models have a higher chance in customer retention while also gaining new customers because they can build large networks and scale rapidly. Hybrid digital business models enable organizations and start-ups to expand the business in different areas for getting more revenues while also offering bundle prices for their services and products (Wirtz, 2019).

The described digital business models in this chapter are the core of digital business. While organizations and start-ups can use different digital business models or combine them in order to form a hybrid digital business models they can also work and innovate their digital business models. There is no framework for digital business model innovation and important is to start it as an experiment. Business model innovation refers to identifying new creative, original ways in which organizations can provide new added value to their products and services. Important is to understand that business model innovation is a different process compared to product and process innovations. The core of digital business model innovation can be the creation of a new value constellation which refers to the added value of products and services, and a new value proposition which refers to the benefit the customers are able to gain from the products or services (Wirtz, 2019). Often digital business model innovations are influenced by market environment, customers' needs and the emergence of new digital technologies.

Organizations can innovate their business model even if it is already digital, because the digital transformation process is an ongoing process once an organization embarks on this journey. While some organizations first digitalized their model or implemented innovative digital technologies, others that already are technologically updated move and change their existing digital business model and the way they interact with their customers. The core of every digital business model is the user. Thus, the more users an organization has, the bigger their customer network becomes and therefore can capture more value. As it can be seen in companies such as Meta (Facebook) that offers free services to their users while taxing their customer on adds placed on their platform. Another good example is Microsoft that has started with the sale of its innovative Windows operating system on CDs. But with advancement

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in artificial intelligence, they have moved from a CD software selling company to cloud company by enabling artificial intelligence to become the core of their business (Iansiti & Lakhani, 2020).

Digital business models are driven by technologies usage focused on their users, and by providing problem solving products and services to their users. Also, many of the digital business models rely on data gathering from their user/customers, following the basic principle "the bigger the data the better". It can be concluded that data has become the most important resource and a massive amount of data represents the most important source of power for the digital organization. Data is gathered not only online by the digital footprint humans leave online, but data is also gathered by IoT products that are more widely used and are able to communicate in real time with the organization. For example, a smart refrigerator can order a new product delivery when something is running out for example milk or butter. Because of the latest innovation in machine learning and artificial intelligent organisations can analyse this huge amount of data in order to obtain better customer insight. This will help in turn the innovation process of better problem-solving products and services. From these examples it can be concluded that these digital businesses offer more convenience and comfort to their customers that are attracted by this type of product or services. Therefore, digital companies that have a digital business model succeed because they use technology innovations to create convenience and comfort to their customers. This can be seen in the business model of UBER, Airbnb, Amazon, Netflix, Apple, their market success, and the ways they used their digital business model to achieve market recognitions while offering different commodity, comfort, or convenience.

When a start-up company or an existing organization that wants to innovate their digital business model, first they must do research on what problem is their digital business model going to solve and how will they be able to offer convenience and comfort for their customers. Is the new product or service able to make a change the live of the customers? Is the company trying to build a network effect based on an existing platform like Facebook, Instagram or TikTok, or by creating its own platform? Because in order to create a network of customers, the feelings of the customers must be considered such as how will the customers feel emotionally when using their products and services, what will be the impact on its family and friends. Is the customer going to recommend the product or service to its acquaintance? In the end each customer must determine if investing in the products and services will be worth for himself of herself. Organizations must also have market insight to determine if there are similar products and services on the market, and to clarify what will be the new added value that can be offered compared to its competitors. Answers to these questions will enable businesses to identify why a customer will be willingly to make an investment and buy their products or services. By asking these questions and doing this type of research businesses can identify the uniqueness of their products and services and build a better digital business model. Then, the organization or the start-up can establish their products and services, and how the new business model is going to be structured.

An important aspect of a digital transformation process is that once started becomes an ongoing one as organizations must learn and adapt in order to survive the upcoming changes. This requirement for profound and complete organizational change comes from new emerging digital technologies, consumerism mentality that changes from one generation to the other and influence their need to gain and maintain competitive advantages. Considering these facts, a lot of organizations are pressured in adopting new digital technologies in order to successfully digitally transform into a digital organisation and acquire new customers while retaining old ones. The organization must consider what technologies is going to use in order to achieve the desired outcome with higher revenue for the business. Some of the following

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technologies, single or in different combinations, can be used by organizations to develop digital business models to compete successfully in the global digital economy.

Internet of Things (IoT)

Internet of things (IoT) has many definitions because its usage is what it defines this technology since IoT refers to different sensors that are used for data collection and are connected to a network (Presser et al., 2019). The IoT has led to an increase in the number of smart lamps, security cameras and other connected devices that users can control via their smartphones. IoT is the technology that has the power to connect everything everywhere with the help of Internet. Businesses can use this technology to create different smart home objects or even home decorations objects that are smart. For example, a smart vacuum cleaner, or smart pet feeder, smart plant pot. Currently, pets are a passion-based niche and business can take advantage of this when they create a digital business model to capture value. In order to create a competitive advantage in this category. organisations can implement sensors in a pet feeder which will allow the owner to control the food and water of its pet when he or she is away at work, even see and talk to the pet. The smart pot is perfect for those that what to grow vegetables or flowers indoors. Business can take advantage of this by enabling plat pot control via a smartphone application. The customer will be notified when the plat is running out to water, also light controls can be programmed or enabled from the same application. At scale, this type of technology can be used in food productions and storage. Organisations that are working in agriculture and farming with the help of IoT sensor can increase their revenue, while producing high quality products for the market demand.

Big Data

Big Data has emerged as an effect produced by the development and usage of new technologies that have enabled the generation of large quantities of unstructured data. Big data covers the way in which data is used by organizations or interested actors such as governments, in other to gain insight on the populations. The umbrella term of Big Data also includes different data processing such as data analytics, data aggregation or machine learning but also data gathering by using different techniques such as data mining (Jabłoński & Jabłoński, 2021). In the digital world data is a key ingredient for the development of a digital business models and the more sources an organization has for gathering data the better the insights about customer's trends or market size will be. Big Data enables organizations to digitally innovate their business models and tailor products and services according to customer's needs. With the help of data analysis and machine learning organizations can change the marketing angle of their products or services. This insight allows organizations to discover what customers' needs are there and to which potential customers they can advertise their current products or service. Big Data has become a very important for digital business models and this is made possible by the ability to collect and analyse data. Organizations can use machine learning algorithms to predict and recommend products for its customers such digital services are used by companies like Meta (Facebook) for product and entertainment advertising, Netflix user a recommendation system for movies based on what the user has previously watch, google on its YouTube platform uses are recommendation system for videos based on what the user has previously watched. Big Data is a very powerful key in the digital economy because it enables organizations to have a better insight of its customers with every action or click a person does on the digital platform.

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Organizations are not only able to collect data from and with the help of different digital platform that provide networking connections for its users like Meta (former Facebook) or TikTok. The data is also collected from different devices as sensors and cameras, since with the development of IoT technologies and the ability of these technologies to be deployed at scale through a variation of smart products that are able to be connected to the Internet. That has given access to organizations to information about the usage of its products because products are able to communicate back their data to the organization. IoT also enables organizations to create smarter production lines, by enabling the organizations to analyse the data received from the machines and devices in the production process and predict the next maintenance activities and allow for real type interventions on every machine (Kumar & Nayyar, 2020).

Artificial Intelligence

Artificial intelligence is defined as the technology with the ability to learn from past experience, adapt over time (Rajendra, 2019). Artificial intelligence can learn by training its algorithms on large quantities of data. Until now humanity was able to develop "weak artificial intelligence" which refers to algorithms that are been able to predict customer's behavior (Kreutzer & Sirrenberg, 2020). Next will be developed "strong artificial intelligence" which is the future of artificial intelligence also known as General Artificial Intelligence, which is going to occur when machines will be able to understand what is happening (Kreutzer & Sirrenberg, 2020). Artificial intelligence can work through large quantities of data and is able to identify data patterns by using mathematical rules. Based on the data given, artificial intelligence has a large scope of usage from computer vision to analytics, to chatbot's (Kamath et al., 2019). Artificial intelligence as a concept is based on neuroscience because it is structured on connections between neurons and was born from the desire of humans to create an artificial mind by imitating the human brain (Kreutzer & Sirrenberg, 2020). Artificial intelligence has "machine learning" as its component, that uses large quantities of labeled or unlabeled data to make predictions and improve over time without human's interventions (Iansiti & Lakhani, 2020). Machine learning is composed of "supervised learning" algorithms that uses large quantities of labeled data, and of "unsupervised learning" which refers to the algorithms that received large quantities of unlabeled data and can identify patterns in this data which are impossible for humans to detect (Kreutzer & Sirrenberg, 2020). Another component of machine learning is "reinforcement learning" which represents the algorithms that can find solutions through trial and error. In other words, every time the algorithms succeed in accomplishing a task it is rewarded while it will be punished every time it fails to accomplish successful the assigned task. Usually, this type of algorithm is applied to path-finding robots or game characters. The last component of artificial intelligence is "deep learning" which is represented by advanced algorithms that can run on larger quantities of data and are able to deliver accurate results. These algorithms use special optimization methods and are also able to generate their own experience in order to learn from it (Kreutzer & Sirrenberg, 2020). These are the core elements of artificial intelligence and as technology innovations advance and computer power grows these algorithms will become better at predicting and seeing patterns in data and produce more accurate results. There are already large companies that are leveraging the power of artificial intelligence such us Tesla for the self-driving cars, Amazon for its warehouses, Netflix, and Facebook.

Artificial intelligence with IoT and Big data go hand in hand when it comes to the structure of the technological process. With the help of IoT devices organizations can gather data this data can be used in training artificial intelligence algorithms, to solve different customer's problems. Some good examples of

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this are in the agricultural field where organizations use drones equipped with camera in order to identify crop diseases. Also, another emerging innovative digital business model is the self-serving supermarkets where customers walk inside, take the products that they want from the shelves and leave. Now these types of stores have an artificial intelligent surveillance system which can identify what product was taken and by who. Also, when the customers are leaving the store, the money is taken form their account for the products they have taken out of the supermarket. This can be the future of the digital supermarkets and is a digital business model that removes all physical interactions between customers and store workers. Robots equipped with artificial intelligent algorithms are used in warehouses, where they can get to the desired product shelf via the shortest path. These warehouses are equipped with IoT environment sensors that can detect if the conditions in the warehouse are not appropriate for the products. Existing organizations and start-ups can use this technology to innovate their digital business model, by promoting high-quality products to their customers which will generate higher revenue.

Augmented and Virtual Reality

Augmented and virtual reality will become game changers in the future of digital business models innovations since they represent the technology which aloes customers to communicate and interact with the digital world in a unique way. Augmented reality represents the technology which overlays 3D virtual object and information over the real world with the help of a smartphone or smart glasses, while enabling the user to keep its connections with the real world (Azuma, 1997). Augmented reality enables businesses to innovate their business models by adding a digital service to a real product. Examples of such products are children book that enhances the book with the help of augmented reality when the child scans the page of the book with the help of its smartphone or tablet and new 3D content enhanced with animation will be shown on the screen. Supermarkets have created advertisement programs by using augmented reality that often invite customers to buy products, and when checking out the receive collectible cards and small toys which often are part of a bigger game. To play the supermarket game customers, need to collect all the cards and other game asset by buying more products from that supermarket. Often the game cards use in such marketing campaigns are enhanced with augmented reality information's. By using this method supermarkets can change the angle of their marketing campaign. While businesses can digitally innovate their business models by using different tactics with the help of augmented reality when it comes to customer's engagement, businesses can also innovate the way in which new employees are trained. With the help of smartphones, tablets and smart glasses like HoloLens organizations are able to provide better training to their employees or assist them with over the shoulder interactions and instructions from experts in the field during maintenance programs or repairs. As the world becomes more digital, humans will want to interact more with digital content and this customer need of interaction will generate new digital innovative business models. Augmented reality will be part of this future since this technology is still at the beginning of its development and the more progress is made the devices that are able to support augmented reality will become less expensive.

Since augmented reality keeps its user still connected to the real world, virtual reality on the other hand represents the technology which fully immerses its user in the digital world with the help of a virtual reality headset (Lavingia & Tanwar, 2020). As any other technology that offers support for humans to interact with virtual worlds this technology is good at creating unique and immersive experiences for its users. Organizations can search for ways to innovate their digital business model by offering their customers immersive experiences such as visiting tourist attractions, immersive game world, but also

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creating the networking effect of the digital platform. One such example of business in the "metaverse" created by the company Meta former known as Facebook company. The metaverse term has its origins from the science fiction novel "Snow Crash" by Neal Stephenson and it refers to a digital world where the user is fully immersed and can use its own costumed avatar to interact with other members of the network. The Mark Zuckerberg's metaverse will be a novel platform which can offer new experiences to its customers such as the user will be able to interact with friends, to buy and sell products or services, that can be digital assets like clothes, house, food and so on or can be real world products. In order to understand better how this digital business model in going to work, by imagining the players of a game like "Escape from Tarkov" where the players can sell their digital items from their inventory. By looking on how digital technologies have progressed and became better with every iteration the authors estimate that it is only a matter of time before the metaverse becomes mainstream. Organizations must figure out new digital business models for this new digital market in this new digital world because it will change everything, from the way businesses will interact with customers by using artificial intelligent avatars, to the way they will provide different services.

Considering the above innovative technologies, the future of business is going to become more digital because all these technologies can work together but they haven't yet been deploying at full scale. Currently, it means that they are too expensive for everyday consumer to use, but as times goes by these technologies will become faster, better and at a lower cost, and therefore they will become available for the mass market.

Some businesses can implement innovative digital technologies and they manage to create great products and services, but they often fail because their business model is not efficient. Other have an excellent business model but their products or services are lacking in quality. In the end when implementing digital transformations across organization a balance must be achieved and organizations must learn to deploy digital technologies while also considering how they run their business in order to be successful in the ever-changing market and gain competitive advantage over their competitors.

FUTURE RESEARCH DIRECTIONS

As technology is going to progress new digital business models will emerge. The authors consider that the next big impact digital business model will be that one which will be able to create a network of users. Since in the next decade trend will be to develop technology allowing a full dive in virtual world, and the company which will create the network effect will become a market leader. Also, organizations must look at the "smart city grid" and develop digital business models for it. Another research direction will be to investigate the quest for innovative digital business models for the companies that have started their digital transformation journey. Since another new dominant trend is creating a "green future", the digital transformation can help organizations create digital business models for the new markets that prioritize reducing global warming and create a greener economy. Other business models that will emerge are those related to space travel since the technologies for space travel have become cheaper, and as they will iterate there will become safer and affordable for the mass population. Finally, new business models are expected to emerge generated by the collaborations between humans and smart machines.

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CONCLUSION

Once an organization has started to digitally transform, the quintessence of this transformation and technologies adaptation will be the business model transformation into a digital business model which will have a different effect on the market, because of the added value generated by this transformation. As seen in this chapter it is very important for organizations to be able to see the elephant in the room which is their business model which is left behind. In other words, digital transformation has an immense impact on every aspect of organizations. Therefore, to survive in the digital economy organizations must learn and implement digital business models that often rely on the network created from its customers or innovate a digital business model because of digital technologies and rapidly changing market needs. Digital technologies can have a huge impact on organizations and create added value to its products and services. By taking these into account when developing an innovative digital business model or implement a hybrid business model organizations must consider the revenue this model is able to achieve to cover the costs generated and obtain a high profitability rate. Another important fact is the constant changing of market needs, which is also generated using technologies and imagining new technologies.

Digital transformation has created a battle between existing businesses and emerging businesses, as it can be seen in today's market businesses that can't transform are forced to exit the market. This research has indicated that an important element that organizations must consider is their business model when they digitally transform their business. Even if the organization is new and its business model is dominating the market chances are that a new business can enter the same market causing the dominant business to lose market share and going bankrupt. Therefore, both traditional and new organizations must learn and innovate their business model to achieve market advantage this is not an easy achievement since the path to this evolution is composed by trial and error.

Therefore, when developing a business model each organization must first determine what problem they will solve for their customers, second, what price they will be willing to pay and if this solution going to create more convenience and comfort for their customers and, third, at what cost the organization will deliver the product or service. By thinking this way organizations can identify new market niches or even create new markets or eliminate competitions in the already existing market. In the end, the customer's biggest problems are creating new opportunities for business. Whit the help of technologies like Big Data, artificial intelligent organizations can gain deeper customers' insight and create a digital business model for that problem and solve the problem by implementing different technologies.

Consequently, it is important for organizations to innovate their business model which can include also the redesign of existing processes and products. Organizations must define if they want to innovate their value proposition which represents the benefit that is provided to customers or innovate their value constellation which defines the structure of added value, and it constitutes the business model core using the mix of digital technologies and competencies. Or in some cases, organizations might innovate their new digital business model by using a combination of the two elements.

Digital business model innovation in existing markets can have an impact on other companies' business models because it can deliver a larger cost advantage and is also able to better satisfy the customer's needs. Even if the organization has already in place a digital business model it is important to continuously innovate their digital business model and invest their resources in their new digital business models. The main factor of influence is the fast and continuous development of digital technologies leading therefore to a continuous process of digital transformation to maintain and develop its competitive advantages and gain a stronger market position.

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Another factor is represented by the development of the sharing economy and of the digital economy that have created improved access to a vast number of different resources for big, medium and small organizations. Consequently, a business is not tied anymore to the geographic area of its founders and can sell their products and services in many other countries around the world. In this context, it is important for an organization to digitally transform, innovate and implement new digital business models because even if it dominates its market segment there is always the possibility of new substitute products or a new competitor entering the market and challenging its position.

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KEY TERMS AND DEFINITIONS

Artificial Intelligence: Special designed algorithm by computer scientists who are trying to create the digital brain based on mathematic calculus and neurosciences. These algorithms can analyze large quantities of data in order to find patterns and make predictions. All artificial intelligence algorithms are designed to get better over time, and with this as a competitive advance these algorithms already have managed to outperform humans in certain tasks.

Augmented Reality: Represents the digital technology that enables users to experiment an enhanced reality by overlaying 3D digital objects and information over the real world.

Business Model: Defines how business can sale their products and services on the market and gain revenue, cover costs and obtain a profit.

Business Model Innovation: Often this is a result from business experimentation in order to gain competitive advantage on the market, and it must be a significant new improvement from the initial model adding more revenue and reducing costs.

Digital Business Model: Has emerged as an effect of the digital technology progress and innovation on organizations and society. Digital business models have a higher rate of success because they can offer better products and digital services to their customers. Digital business models rely on the business ability to create a network of customers on a digital platform.

Digital Business Model Archetypes: Is a term used to describe the tree basic digital business models which are the platform model, the community model and the circular model.

Digital Economy: Is that part of economic output derived solely or primarily from digital technologies with a business model based on digital goods or service – consists of the digital sector plus emerging digital and platform services.

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Digital Transformation: Digital transformation of an organization represents a strategic process of profound change in scope, both integrally and systematically affecting each component of the organization and the relations between them, executed gradually, through step-by-step changes, having a continuous character, without stopping when a final desired form is reached, and aiming for a long-time horizon.

Sharing Economy: All activity related to the production, consumption, and trade of goods and services in an area based on Information Technology-facilitated peer-to-peer model for commercial or non-commercial sharing of underutilized goods and service capacity through an intermediary without a transfer of ownership.

Virtual Reality: Represents the digital technology that enables user to be fully immersed in a digital world with the help of a headset. When using this digital technology, the user loses the connection with the real world, in other words this technology provides the customer to dive into the digital world.

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Chapter 16
Organizational Readiness/ Maturity Considerations for Blockchain Adoption

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ABSTRACT

Digital transformation involves new concepts, radical innovation, and radical organizational change across multiple organizational dimensions. Blockchains can be considered a form of digital transformation for organizations. An aspect of the radical nature of blockchains flows from the capabilities it can provide for trustworthy transactions between organizations. This creates opportunities for new business models by disintermediation of some parties to traditional transaction flows in the same industry or supply chain. Multiple parties have to agree to adopt the new style of transactions. Scorecards and metrics for multiparty technology adoption have additional scope that metrics within a single organization do not. Organizational readiness and maturity metrics for effectively utilizing blockchains have to address the broad range of business considerations that management should consider when evaluating opportunities for digital transformation via blockchain.

INTRODUCTION

Achieving a digitalized economy assumes a process of digital transformation with digital technologies being adopted and new management techniques to effectively manage the identification of suitable technologies; match technologies with organizational opportunities; and then administer the organization in the digitalized economy. Blockchains are increasingly proposed for a wide range of different applications. Blockchains can be considered a form of digital transformation for organizations' business processes, business models, and more. Organizations are attempting to develop and deploy blockchain based solutions with varying degrees of success. Blockchains are associated with a decentralized implementation architecture which often contradicts centralization assumptions inherent in both IT infrastructure (e.g.,

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Client-Server) and in organizational processes and management structures. Blockchains also enable Decentralized Autonomous Organizations (DAOs) which may be better considered as a software implementation of organizational governance rather than a typical technology for process automation. The availability of appropriate metrics will be key for organizations to assess blockchain technologies and deploy them as they transform towards the digitalized economy.

For other significant digital technology deployments, organizations have been using a variety of metrics or scorecards to assess the maturity of their processes related to the technology; and their readiness to develop and deploy solutions based on digital technology. Scorecards and metrics can assist organizations in assessing their process maturity and readiness for deploying blockchain based solutions, if they are appropriate for the type of digital transformation proposed. The mission of this chapter is to provide a view of the applicable organizational readiness and maturity metrics for effectively utilizing blockchains for those concerned with management science and practice. This view provides perspective on where scorecards and metrics are well developed, and where there are gaps.

Metrics and scorecards help organizations evaluate their readiness for blockchain implementations. This chapter starts with a review of the decision processes associated with blockchain selection and adoption; then considers the readiness of businesses for digital transformation via blockchain adoption; before reviewing the maturity or readiness metrics for organizational transformation. Blockchain technology developments have been continuing with increasing attention to architectural choices, design, and development methodologies. Decision processes for blockchain adoption documented in the literature are typically derived from a technology perspective. That technology perspective highlights the capabilities of the technology but lacks an understanding of the organizational context. Both intra-organizational and inter-organizational technology adoption tend to be analyzed with similar frameworks such as the Technology, Organization, and Environment (TOE) framework. Business readiness metrics predate the development of blockchain technologies with various kinds of metrics and scorecards to evaluate dimensions of organizational performance, including capabilities to adapt to technological change. Most of the business readiness/maturity metrics focus on internal technology adoption. A digitalized economy, and blockchains, need readiness metrics that apply across organizations. The digital transformation of an organization for the digitalized economy goes beyond mere technology adoption within existing organizations and includes new forms of digital native organizations such as DAOs. DAOs can use blockchain technology to transform organizational governance and the nature of work. While there is a plethora of advice on technology metrics and technology adoption, digitalized organizations is a much newer concept with fewer metrics available to guide adoption.

Decision Processes for Blockchain Selection and Adoption

Blockchains are an evolving technology with variants already developed and deployed. Some refer to stages of blockchain technology development maturity using numerical generations (Mukherjee & Pradan 2021). *Blockchain 1.0* is focused on cryptocurrency applications e.g., Bitcoin. *Blockchain 2.0* extends applications beyond cryptocurrencies with smart contracts. Smart contracts provide a trustworthy computing paradigm through consensus results of computations on the blockchain. Many of the *Blockchain 2.0* smart contracts have been focused about decentralized finance. *Blockchain 3.0* expands the range of decentralized applications further and addresses scalability and performance issues from previous blockchain generations. These improvements were enabled by a range of architectural options within specific blockchains e.g., Directed Acyclic Graphs (DAGs), alternate consensus mechanisms,

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etc. Interconnection between blockchains and transactions across different blockchains then becomes a challenge. *Blockchain 4.0* as a business usable platform is intended to address these challenges as well as incorporate other technologies such as artificial intelligence to provide a more complete solution. While there are no formally agreed definitions for these generations, various analysts have used this nomenclature as an indication of blockchain technology maturity in supporting a wider range of applications.

Such technology metrics describe the attributes of the technology e.g., performance. Technology metrics, however, do not tell us how ready or mature an organization is when selecting, adopting, or transforming, using blockchain technologies. Other metrics are required to identify organizational factors impacting successful blockchain adoption (Clohessey & Acton 2019). Technology metrics do however provide a place to start in characterizing the technology being adopted. The following sections explore the attributes of blockchain technologies from the technology perspective before reviewing the challenges of the technology perspective and looking at common technology adoption frameworks.

TECHNOLOGY PERSPECTIVES

There are several antecedents to modern blockchain technologies, but arguably the technology developed a broader momentum with the development of Ethereum around 2015. The *turing-complete* virtual machine supported by Ethereum enabled easier programmability of a broader variety of decentralized applications well beyond cryptocurrencies. This resulted in a much broader range of potential applications (Casino et al., 2019), and consequently papers discussing how best to apply the technology. The technology driven perspectives generally took a *technology-fit* approach. For example, in deciding whether to use a blockchain Peck (2017) suggests the following questions

- Can a traditional database technology meet your needs?
- Does more than one participant need to update the database?
- Do you and all those updaters trust one another
- Is this database likely to be attacked or censored?
- Do you need multiple redundant copies in multiple distributed computers?
- Would all the participants trust a third party?
- Does the data need to be kept private?
- Do you need to control who can make changes to the blockchain software?

Later, the blockchain deployment advice literature focuses more on themes, or intended application areas e.g., building on notions of a blockchain as an evolution of a ledger, or a database. The *Blockchain 1.0* through *Blockchain 4.0* terminology is an attempt to both categorize and sequence application areas. Much of the literature on blockchain *technology-fit* (for example, Belotti et al., (2019), and Wüst & Gervais (2018)) position blockchains as an evolution from ledger and distributed ledgers. From this technology-fit perspective, the critical questions to ask determine *when* to apply blockchains. Do you need to store and share a ledger state? Are there multiple potential writers? Who do you entrust with ledger maintenance?

The *technology-fit* of blockchains is bifurcated between permissioned and permissionless blockchains. Permissioned blockchains have a centralized authority to establish permissions. This makes some features like access controls easier to develop and impose compared to permissionless blockchains. Narumanchi

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& Emmadi (2018) evaluated the readiness of permissioned blockchains for enterprise use but considered that there were multiple non-trivial technical challenges to be resolved. Koens & Poll (2018) surveyed academic literature, and the web, to identify 30 blockchain decision schemes and classified them in terms of the recommendation being made: whether a blockchain should be used; which type of blockchain should be used; or which alternative technology should be recommended.

These theme-based application targeting papers continued in 2019. For example, Pedersen et al., (2019) framed the blockchain technology decision in the following questions:

- Need for a shared common database?
- Multiple parties involved?
- Involved parties have conflicting interests/trust issues?
- Parties can/want to avoid a trusted third party?
- Rules governing system access differ between participants.
- Transacting rules remain largely unchanged?
- Need for an objective immutable log?
- Need for public access?
- Are transactions public?
- Where is consensus determined?

By 2020, the application targeting papers are including more non-functional characteristics of commercial applications e.g., privacy and security. The question of *which* blockchain to use is also driven by whether the intended use is as a system of record or as a platform. The question of *how* to use blockchains is then driven by more traditional IT implementation considerations of where to focus the organizations efforts e.g., directly participating in open source blockchain software infrastructure projects, or on decentralized applications leveraging existing blockchain infrastructures that might even be provided by others as a service (Blockchain as a Service). For example, before going on to categorize blockchain security threats into mining threats, network threats and smart contract threats, Puthal et al., (2020) framed the blockchain selection problem in terms of the following questions:

- Does the system need permanent shared data storage?
- Are there multiple data contributors to the system?
- Does the application modify data after storage?
- Is data privacy required?
- Does the system work in an untrusted environment?
- Does the system need tamperproof data storage?

Blockchains provide several features and various authors have used to those features as part of their decision process to identify useful problem spaces in which to apply blockchains. Part of the challenge here is identifying the features of blockchain that provide significant value compared to existing alternative solutions. If the focus is on a narrow technical feature, then alternative technology features become easier to identify. An aggregation of multiple technical features is, however, required to support a commercially viable system application. The aggregate features of blockchains when organized as a Decentralized Autonomous Organization (DAO) become more difficult to replicate with individual piecemeal technologies. For Andolfatto (2018) the comparative advantage of blockchains lies in this

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ability to support DAOs. DAOs (as organizations) still benefit from the technology of the underlying blockchains but require an organizational perspective rather than a technology perspective when considering their adoption.

Challenges from Technology Approach

The main challenges in blockchain technology literature are presented in technology aspects such as security, scalability, etc. Adoption in commercial and governmental applications has not been as rapid as some early technology pundits expected. When considering the application of the technology in commercial or governmental organizations, additional technological, organizational, and environmental considerations impact adoption decisions. Much of the advice on blockchain adoption is driven from the perspective of the technological capabilities of the blockchains e.g. (Gopalakrishnan et al., 2019). *Technology-fit* with application requirements is an important consideration for many technology deployments. Applications with a good technology-fit may be necessary for successful implementations but is hardly sufficient given the confounding factors in organizations and broader inter-organizational or economic factors.

Using grounded theory-based data collection and analysis, Post et al., (2018) identified 13 factors affecting blockchain technology diffusion which they the classified as *strategic*, *tactical*, or *operational.* The factors were - necessary collaboration, necessary paradigm shift, market position adoption, compliance, sector pressure, organizational size, investment hesitation, knowledge deficit, viable use cases, implementation method, change readiness, technological shortcomings, process maturity. While a given organization may have strategic, tactical, or operational perspectives in its deployment of technologies, these perspectives may not be easy to generalize across organizations in different industries, competitive situations, etc.

Most of the technology adoption perspectives assume the technology is an IT system (e.g., a database) internal to an organization. Much of the advantage of blockchains, however, derives from the ability to develop trusted transactions between remote parties. An interorganizational information systems context, such as a supply chain, provides an interesting perspective on the tensions and tradeoffs leading to adoption. In this context, the value of adoption is significantly greater if all the supply chain participants adopt the same technology. This requires coordinated technology adoption across multiple independent firms. Sternberg et al., (2021) identified tensions between supply chain participants concerning the appropriate blockchain design requirements along four different dimensions:

- Traceability-efficiency
- Visibility- privacy
- Trust-investment
- Performance-commitment

Technology metrics provide a place to start in characterizing the technology being adopted. Technology metrics describe the attributes of the technology e.g., performance. Technology metrics, however, do not tell us how ready or mature an organization is when selecting, adopting, or using blockchain technologies. Other metrics are required to identify non-technical factors impacting successful blockchain adoption. Adoption of specific technologies can be an explicit or implicit strategic decision at various levels within an organization. Organizational and environmental factors are non-technical approaches

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that have been used to study the adoption of other technologies and may prove helpful for consideration with blockchains.

Technology Adoption Frameworks and Blockchains

Despite technology feasibility, technology deployments often fail due to a variety of other factor regarding the readiness of the organization to adopt the new technology. Balasubramanian et al., (2021) structured their literature review into organizational readiness for blockchain adoption for healthcare applications in terms of three questions: (i) Who are the key stakeholders, and how do they collaborate and/or cooperate? (ii) What are the key readiness dimensions of individual stakeholders, and how do they influence the sector? (iii) What are the key facilitating conditions? The key stakeholders they identified were governments, business entities, blockchain solution providers, and customers/end-users. The dimensions of stakeholder readiness identified were motivational readiness, engagement readiness, technology readiness, structural readiness. The key facilitating conditions identified were: supportive regulatory and legal structures, innovation propensity, privacy and trust, supporting infrastructure.

A common framework to view technology adoption challenges is to view it from the perspectives of Technology, Organization and Environmental (TOE) perspectives. From a review of the literature in governmental blockchain applications, Batubara et al., (2018) used the TOE to categorize technology adoption challenges as Security, Scalability, Usability, Interoperability / compatibility, Reliability, Flexibility, Cost effectiveness, Computation efficiency, General application platform, Storage size, Immaturity, Design variables. Significant non-technical challenges were also identified. The Environmental challenges identified were -Laws and regulations support, Support infrastructure, Accessibility (the matter of the digital divide). The organizational challenges were identified as:

- Organizational readiness
- Acceptability
- Business model/ organizational transformation
- Risk of error for complex business rules
- New governance model
- Implications
- Trust
- Auditing

With data derived from semi-structured interviews, Toufaily et al., (2021) developed a conceptual framework to assess blockchain adoption using the TOE framework to assess challenges. The external environmental challenges identified were regulatory uncertainty, network effects and inter-organizational connectedness, ecosystem readiness. The identified organizational challenges were governance and leadership issues, business model alignment, organizational readiness. Overcoming those challenges was expected to result in value added to the ecosystem. When evaluating blockchain adoption, Clohessy et al., (2020) proposed extensions to the TOE framework to also consider individuals and tasks as additional perspectives. Individual perspectives tend to focus on expectations, trust and privacy depending in the individual's role and interactions with the blockchain. This study was based on a structured literature survey, but that survey may have been biased towards cryptocurrency applications of blockchains (e.g.,

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Bitcoin) as opposed to non-cryptocurrency applications. The task perspective considers mainly the task-technology fit.

Multiple technology adoption frameworks have been developed and applied for technology adoption decisions processes. Integrating the Technology Readiness Index (TRI) and the Technology Acceptance Model (TAM) Lin et al., (2021) to develop a Technology Readiness and Acceptance Model (TRAM). Wahyuni et al., (2021) applied this TRAM model in the context of blockchain adoption in micro, small, and medium enterprises in Indonesia. The TRAM model proposes that technology readiness is a causal antecendent of both perceived usefulness and perceived ease of use which subsequently affects intention to use. While adoption intentions are clearly necessary for technology adoption, other non-technical factors also impact the likelihood of successful implementation.

As the name implies, technology adoption frameworks are focused on the adoption of technology by some entity. From this perspective, technology is a tool to be used/ adopted or not. The use of new tools changes the processes of the tool users whether they are individuals or organizations. Re-engineering business processes is a form of transformation. The transformation, however, is of the business processes rather than the business model, or the nature of the organization and the ways in which it interacts with others. An organization exists to implement its purpose and for commercial organizations that business purpose is typically described as one or more business models. Technology adoption decisions are typically mechanisms to efficiently implement a particular business model. As the business model changes, the organization to implement that business model may need to change. Changes in the business model are a qualitatively different form of organizational transformation.

BUSINESS READINESS FOR BLOCKCHAIN DIGITAL TRANSFORMATION

Digital transformation involves new concepts, radical innovation, and radical organizational change across multiple organizational dimensions. Blockchain introduces a new concept of trustworthy transactions by using decentralized consensus mechanisms and cryptographic signatures on transactions. Blockchain is a radical innovation because its decentralized architecture is a departure from traditionally centralized information technology systems. Blockchains (as a trust-machines) can enable automated transactions between remote parties without intermediary clearing houses. Disintermediation through trustworthy transactions is a radical organizational change across multiple organizations. Another radical aspect of blockchains follows from the capabilities it can provide for trustworthy transactions between organizations with an opportunity for disintermediation of some parties to traditional transaction flows in the same industry. This has led to many proposals for business model innovation, with consequential changes in the operating model, and business processes.

Because of these new concepts, radical innovation, and radical organizational change, blockchains have been heralded as a disruptive form of digital transformation by several industry analysts (Tapscott & Tapscott 2016). Digital transformation has been observed to occur in phases: Digitization - where analog records are converted to digital; Digitalization - where IT technologies can be used to alter existing business processes; Digital transformation - where pervasive companywide change leads to new business models (Verhoef et al., 2021). Blockchains manage digital assets hence requiring digitization as a prerequisite. The changes in business processes from digitalization are not easily identified from the technology considerations in the previous section, although significant business process performance

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improvements are often expected for automation. The business model changes associated with digital transformation may also lead to much more radical organizational restructuring.

Adopting a new technology within a single organization is a simpler task than changing the transaction mechanisms and flows within an industry. Multiple parties must agree to adopt the new style of transactions. Various industries bodies have proposed blockchain solutions within their industry based on permissioned blockchains. Permissioned blockchain architectures work for industry consortia because of the limited number of participants. Where the proposed business model requires a wider group of participants e.g., consumer markets, then permissionless blockchains may be necessary. Whether permissioned or permissionless architecture is used, the adoption challenge remains. Adoption of the technology will be constrained if the participants necessary for success do not have the requisite process maturity and technology capability readiness to effectively use the blockchains. Scorecards and metrics for multiparty technology adoption have additional scope that metrics within a single organization do not. Supply chains have been identified by some analysts as particularly appropriate for blockchain adoption (Tapscott 2020). Some factors associated with readiness have already been identified in the context of supply chains (Etemadi et al., 2021).

Because blockchains is a radical transformation, the availability of metrics and scorecards becomes even more important to guide their commercial implementation. A brief background on the roles of scorecards and readiness in digital transformation is provided in the following section. Following that context material, the subsequent sections explore notions of readiness indicators at different scales – within a business function, within an organization, and at inter-organizational scales.

Scorecards and Readiness in Digital Transformation

Scorecards have been used to provide executives with a broader perspective on company performance than traditional financial metrics. The balanced scorecard of Kaplan & Norton (1992) is perhaps the most well-known such scorecard. Readiness is a measure of some entity to respond. In considering readiness for adoption of blockchain technologies and related applications, the scale of the intended blockchain affects the challenges faced and the dimensions in which readiness can be measured. Vlachos et al., (2019) proposed an index for ranking nations in terms of their blockchain readiness. This readiness index was based on dimensions of government regulation, research, technology, industry, and user engagement.

It is difficult to design organizational structures without considering the way digital technologies are radically affecting firms' operations. Holmstrom (2021) framed digital transformation in four dimensions – technologies, activities, boundaries, and goals. Ahmad et al., (2021) surveyed the literature to identify metrics critical for different phases of digital transformation. The key digital metrics of digital transformation were organizational agility, operations flexibility, value proposition of digital transformation products and services, customer focused measure, digital resources measures and transformation management measures. For categorizing digital transformation strategies, Tekic & Koroteev (2019) used a 2x2 matrix comparing the enterprises' mastery of digital technologies vs the readiness of their business model for digital operation.

The economic theory of the firms relies on the reduced costs of internal communication and control activities compared to external transactions. While department level structures and subsidiary company organizations may provide impediments to internal communication and control, this should still be easier than external transactions. Traditionally economic efficiency within a firm has been achieved through centralization of governance (management) decision making, and also centralization of resources.

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Blockchains are typically considered as a tool for decentralization. This mismatch creates a challenge for blockchain adoption.

Blockchain is a global digital transformation across multiple industries with significant blockchain firms and investments in Beijing, London, and Silicon Valley (Holicka 2021). As business model innovation is a significant motivation for blockchain usage, factors impacting the viability of business models become important to evaluate. One of the requirements of business model innovation is to understand the legal context supporting the business models so that risks associated with commercial disputes and regulatory burdens can be mitigated. Many business model innovations can simply assume the current business's legal environment. With international transactions enabled by permissionless blockchains, participants may risk being subject to multiple legal jurisdictions. Even if transactions are constrained to the local jurisdiction, there may be a regulatory impact due to evolving regulations (de Filippi & Wright 2018). As blockchain is a new technology, regulatory agencies are presented with the challenge of how to classify blockchain operations under existing regulations which were likely written with other operational frameworks in mind. Legal risks from regulatory misclassification could result in increased regulatory reporting or tax burdens.

Note that these organization scorecards and metrics are largely technology agnostic. These organizational factors do vary, however, by the scale of the organizational transformation under consideration. The following sections consider increasing the scale of the transformation from a business function to an organization and then inter-organizational technology adoption.

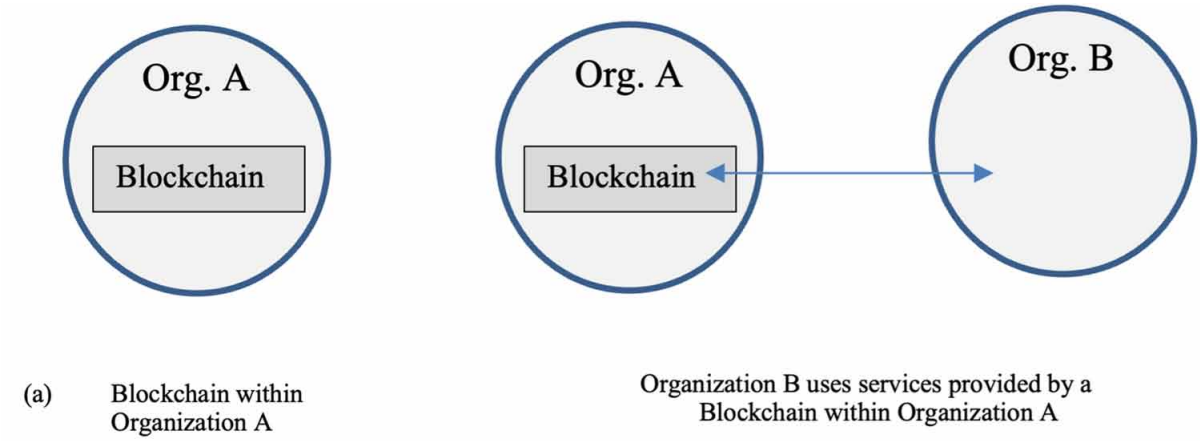
Readiness of Business Functions for Blockchain Adoption

Blockchains could be implemented as an internal function within an organization as shown in Figure 1 (a). Alternatively, the blockchain functions could be outsourced to another organization and delivered as a service as shown in Figure 1(b). Obtaining blockchain services via another organization may have less impact than if all the functionality is implemented directly. Implementing a technology within an organization is typically driven by one department or business function where the technology can improve efficiency or deliver other competitive advantages.

Most blockchains are built as decentralized ledgers. Most organizations manage ledgers in their accounting functions, so this might at first glance seem a technology-fit area where blockchains would be more easily deployed. The accounting functions for internal audit, however, are focused on governance, risk management and controls with significant procedures and regulatory guidance developed assuming centralized ledger database. As an example, accounting books and records are typically balanced periodically e.g., monthly while blockchains transactions are continuously balanced. As Rooney et al., (2017) point out, this creates a mismatch between the professional norms and organizational procedures of accounting, and potential applications of the technology.

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Figure 1. Blockchain may be implemented as a Business Function



The *technology-fit* may be useful in identifying potential applications for the technology, but department- specific readiness and maturity metrics would also be relevant. General organizational approaches for readiness and maturity metrics such as Holmstrom (2021), Ahmad et al., (2021), Tekic & Koroteev (2019) may provide a useful starting point, but these still need to be reduced to the context of a business function rather than an aggregate organization.

Readiness of Organizations for Blockchain Adoption

Most of the technology adoption frameworks focus on the whole organization (e.g., the company) as the unit adopting the new technology. TOE framework is widely used in the literature but is not the only approach.

The TOE framework is a common tool to evaluate the interplay between technology organizations and the environment in which they operate. For example, Malik et al., (2020) used the TOE model to consider blockchain adoption in Australia. Technology factors were perceived benefits, perceived compatibility, perceived complexity. Organizational factors were organization innovativeness, organization learning capability, top management support. Environmental factors were competition intensity, government support, trading partners readiness and standards uncertainty.

TOE is not the only framework that could be used. For example, Younus & Raju (2020) used a combination of Task-Technology Fit (TTF), Unified Theory of Acceptance and the Use of Technology (UTAUT) and Resource Based View (RBV) to examine factors impacting blockchain smart contract use in oil and gas companies. Using interviews to focus on the timing decision for technology adoption, Schmick & Shull (2020) identified technology maturity and market demand as key factors. Developing economies may offer an interesting perspective for blockchain adoption because there may not be existing infrastructures and services that must be displaced. For blockchain adoption readiness, Broni (2019) adapted the Perceived E-Readiness Model of Molla & Licker (2005) which assesses both the organizations internal (organizational) readiness and the external readiness. They developed a Blockchain Organizational E-Readiness assessment considering awareness, human resources, technology resources, business resources, commitment, and governance. They also developed a Blockchain External E- Readi-

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ness assessment considering governmental readiness, technological readiness, market readiness and educational readiness. Reviewing manager resistance in the blockchain literature, Walsh et al., (2021) identified multiple resistance constructs - individual resistance, perceived value, perceived switching costs, perceived need for new infrastructure, perceived switching benefits, simplicity of infrastructure, self-efficacy for change, organizational support, environmental support. The organizational barriers identified by Seebacher & Schüritz (2019) included:

- Project management issues
- Organizational readiness
- Top management support
- Participation cost
- Lock-in effect & maintenance of parallel IT
- Legal implications
- Internal resistance
- Technology driven implementation
- Awareness & perception of benefits

An organization centric view of technology adoption assumes that the adoption decision is independent of external factors. Beyond the resistances of various actors and project management issues common to many IT projects, the decentralized nature of blockchain technologies seems to require process changes beyond simply implementing a new IT system. Blockchain transactions (e.g., with external parties) may not be a "drop-in replacement" from a legal perspective resulting in changes in business models. While some blockchain deployments may be internal to one organization, the decentralized nature also fits interorganizational applications.

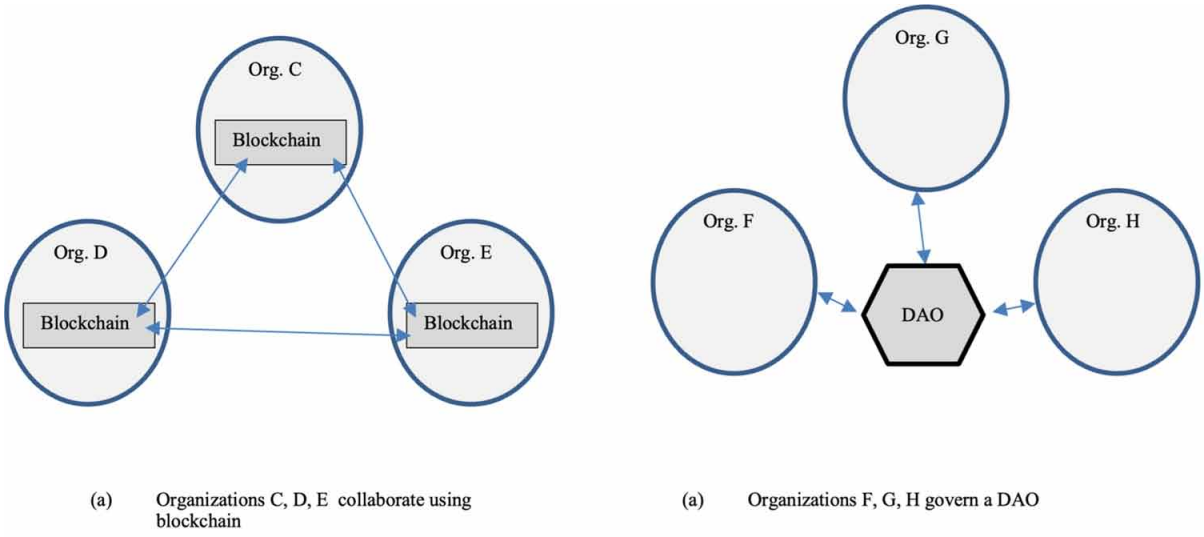
Readiness of Industries / Between Organizations for Blockchain Adoption

If the *technology-fit* between the task and technology is good for one firm in an industry, then it might be expected that multiple firms in that industry could leverage the same technology. Various industry reports have suggested that blockchain could be a significant contributor to digitalization in the construction industry. Using semi-structured interviews to develop a SWOT analysis, Tezel et al., (2019) investigated how to prepare construction industry supply chains for blockchain. Cryptocurrency applications and decentralized finance in general are major application areas for blockchains. Hence adoption of the technology in the banking industry might be instructive. Ozturan et al., (2019) assessed the readiness level of the Turkish banking industry for blockchain technology. They framed their enquiry in terms of three domains – strategic, organizational, and technical. A survey instrument was then used to assess the readiness within each domain. To assess the level of blockchain technology maturity in the oil and gas industry, Bazaee et al., (2020) applied the Capability Maturity Model (CMM). The CMM categorizes technology maturity into one of five levels – emerging, identified, defined, operational and mature. In the context of supply chains, blockchains offer considerable promise, but require significant organizational change. Johnson et al., (2020) studied the third-party companies providing temperature--controlled storage facilities to identify their preparedness and identify factors impacting their readiness. They framed their enquiry using an Organizational Readiness to Change framework based on two factors – the organizations willingness or commitment to change and the organizations' capability to effect the change.

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When blockchains are adopted in an interorganizational context, the approaches can be categorized depending on whether the blockchain is viewed as part of the participating entities, or as a separate organizational entity. Figure 2 illustrates these categories of interorganizational adoption of blockchains. If Figure 2(a) the blockchain operates as an interorganizational IT system where each of the entities participates. Figure 2(b) illustrates the alternative case where the blockchain is treated as a separate organizational entity – a Decentralized Autonomous Organization or DAO.

Figure 2. Blockchain may be implemented as an Inter-organizational Business Function or as a separate organizational entity



(a) Organizations C, D, E collaborate using blockchain

(a) Organizations F, G, H govern a DAO

Inter-organization information systems are less common than IT systems deployed within a single organization. Individual organizations can more easily deploy systems if they can do so independently from other organizations. Platform providers may make APIs available to an industry, but then manage the life cycle upgrades of that API. The lifecycle deployment and upgrade operation decisions become more complex when the industry is a collaboration of peers, rather than a platform ecosystem. In some cases, industry bodies or open-source communities may provide the feature release coordination for interorganizational software that would traditionally be provided by a platform provider. Seebacher & Schüritz (2019) use interviews and structured literature review to examine the challenges for blockchain adoption as an interorganizational information system. From the literature review, the challenges faced by interorganizational information systems were classified as technical, organizational, or network barriers. The technical barriers included a lack of technical capabilities, compatibility of infrastructure/IT and missing IT standards. The network barriers included:

- Control over information resource
- Compatibility of business & social structures
- Harnessing of network externalities
- Collaborative mindset

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- Adoption behavior of competitors
- Cultural bias
- Trust
- Degree of dependency & power structures
- Missing goal alignment

Blockchain is considered a disruptive technology for several reasons. The decentralization of blockchains often requires changes in business processes for existing organizations to adopt it. Milani et al., (2020) identified several heuristics for redesigning business processes adopting blockchain solutions which they groups into categories of entity collaboration – changing the perspective from organization internal to interorganizational, case management structure- focusing on the computational requirements to achieve the desired outcome, data management- focused on the data communication and governance required between mutually distrusting entities, and tokenization – a method for managing digital assets. These heuristics consider reengineering the business processes between the organizations e.g., Consider integrating participating entities' business processes or activities thereof in the inter-organizational process; Consider organizing inter-organizational processes around their outcomes and use connected smart contracts for task execution; Consider outsourcing complete processes or parts of it that are executed by participating entities, in particular duplicates, to smart contracts; Consider digitally representing assets that are used in the inter- organizational process with tokenization; Consider capturing data once and at its source from participating entities and oracles.

For blockchain systems coping with decentralization becomes even more pivotal than other interorganizational information systems. The lack of trust or willingness to share information is an impediment to most interorganizational information systems, but this is an explicit objective or requirement for many blockchain implementations. For blockchain systems, the benefit to a single company depends on the success of the entire network. Where organizations collaborate using blockchain implementations (Figure 2(a)), this can be seen as a common commitment towards blockchain infrastructure. Where organizations collaborate using a separate entity (a DAO as in Fig 2(b)) that relies on the blockchain to perform its function, the organizations are more focused on the purpose of the transactions rather than the underlying blockchain infrastructure.

ORGANIZATIONAL TRANSFORMATION READINESS AND MATURITY

The endpoint of the digital transformation of an organization is an entity that is natively digital. A natively digital organization is one whose key governance processes are software mediated. While artificial intelligence may be useful it is not a necessary requirement here. Humans may be the owners, employees of, or contractors with, a digitally native entity as long it has legal recognition as an entity. Corporations have had broad recognition as artificial legal entities for over a hundred years. Legal recognition of software-based entities is a more recent development. Delaware, Vermont, and Wyoming have recently extended their enabling statutory language to provide varying degrees of support for blockchain-based organizations. Digitally-native, blockchain-based organizations are usually categorized as some form of DAO. Any discussion of digization at the organizational level should thus consider DAOs for reorganization of existing organization, or when deploying new organizations.

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The following section considers the rational for readiness or maturity indices available when organizing or reorganizing. The variety of organizational transformations using DAOs is then discussed before considering the transformation of organizational governance using DAOs. The potential transformation of human work by humans working within DAOs is also introduced as an emerging topic.

Rationale

Readiness or maturity indexes are significant instrument for measuring and managing digital transformations. There have been various readiness models proposed in the literature including factors such as attitudinal readiness, action readiness, etc. (Nasution et al., 2018). Other studies on organizational readiness for digital transformation mix measures of maturity and readiness including e.g., maturity of the company's architecture, maturity of data management processes etc. (Lezina 2019). Because blockchains, particularly permissionless blockchains, require multiple parties to adopt them, many blockchain developers have chosen to utilize open-source software business models. Many of these open-source projects and communities are relatively new. Organizations considering adoption of open source blockchain technologies might find assessment of the maturity of such open-source communities to be an important aspect. (Lenarduzzi 2020) reviewed published approaches to evaluating open-source software. Digital transformation is a decision considering strategic positioning, strategy implementation capabilities and choices, and the identification of risk management approaches. Organizational readiness and maturity metrics for effectively utilizing blockchains, however, must address the broader range of business considerations including DAOs as an entity form. .

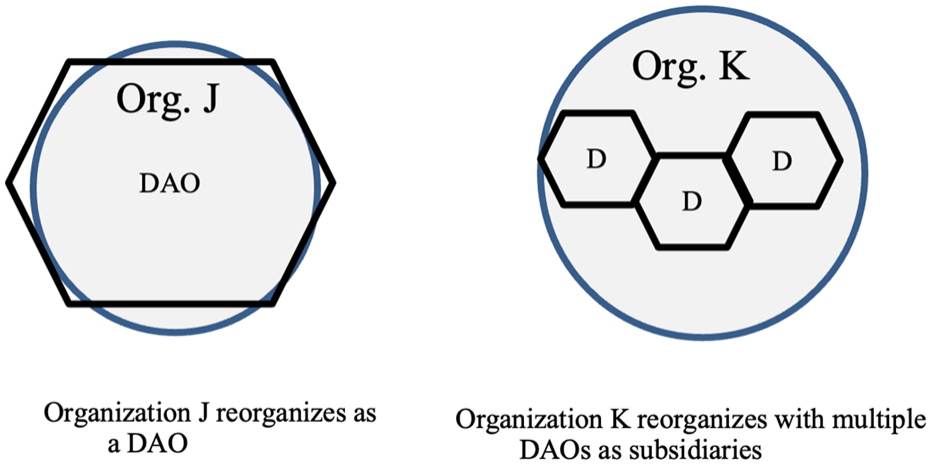
Metrics for transformation of not just internal business processes, but the organization itself including business models, structure and relationships with other organizations do not appear to be well developed. Organizational structures can be misaligned with business processes. For example, Boeva et al., (2017) used internal email clustering as a mechanism to view the alignment with formal organizational structures. Heuristics and best practices for restructuring organizations exist e.g., start with executive sponsorship; tie strategy to design; use a structured approach; keep business process work simple; collect data and use it; consider the various options; be aware of trade-offs; keep the focus on people; avoid declaring victory prematurely; and get an early handle on the IT systems (Recardo & Heather, 2013). Senior management commonly seeking better alignment between business processes and strategic intent. Balogun (2007) argues that any shift in organizational form requires an accompanying cognitive orientation. Organizational structure and management are typically categorized as a management function rather than a technology tool. The advent of technology tools such as DAOs enable new form of software mediated organizational governance. The readiness and maturity indices to support such forms of organizational governance are still emerging.

DAOs as Organization Transformation

An organization may use one or more DAO entity structures as illustrated in Figure 3. An organization may be structured as a single DAO as shown in Figure 3(a); use multiple DAOs as subsidiaries (Saurabh et al., 2022) as shown in in Figure 3(b); or both to form a DAO of DAOs (Kaal 2021).

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Figure 3. An organization may use one or more DAO entity structures



Blockchain technology can be viewed as innovative from various perspectives – as a technology, a platform, an application, or business model, and as a form of governance. It is not only DAOs, but also platforms and other interorganizational uses of blockchains that Shaffers (2018) points out as having distinctly different governance challenges. For example, deciding to adopt a software version upgrade is much simpler in one organization than when such an upgrade needs to be achieved across a community of collaborating entities. From a legal perspective, entities collaborating in the use of a blockchain might be considered in some form of partnership unless some other explicit legal structure is provided. As Zetsche et al., (2018) points out, this partnership structure is not very attractive from a liability perspective. Traditionally decisions on governance structures for joint ventures were largely driven by the intent for joint research and development and the technological intensity of the product area (Osborn & Baughn, 1990). More recently open source has emerged as a significant new paradigm for joint research and development (Wright & Druta 2014).

The creation or redesign of organizational structures (whether legal entities or internal divisions) is typically considered a management / governance function of the organization rather than a technology. Blockchains, and more specifically, DAOs have recently emerged as a new type of legal entity (Wright 2021). New instances of legal entities are often created when operating in different jurisdictions, or tax reasons, or associated with corporate mergers and divestitures (Joy 2018).

DAOs as Transformation of Organizational Governance

Software-mediated organizational governance is a significant transformation from existing human centric approaches. The software mediation makes digitally explicit, and potentially more transparent, what have traditionally been effable analog human interactions amongst relatively closed groups of managers. The decentralized nature of blockchains (and DAOs) affects strategic management, changes organizational design, and requires a new form of corporate governance (Van Rijmenam et al., 2021). DAOs can be viewed as establishing algorithmic organization. At the same time, DAOs rely on a more pluralistic and decentralized form of algorithmic management (Mini et al., 2021). Zwitter & Hazenberg (2020) argue

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that the current dominant modes of governance are inadequate in understanding governance in the digital domain and are poorly equipped to conceptualize novel forms of governance such as DAOs.

Postulating the encoding of all operating rules of a group of individuals in a DAO, Sulkowski (2019) suggests that businesses could use the technologies underlying a DAO to limit human discretion by "hardcoding ethics." Beck et al., (2018) developed a research agenda for DAO governance as an extended form of IT governance based on decision rights, accountability, and incentives. Radical organizational restructuring using DAOs would be a significant change in the market structure. Such a significant change in market structures would likely require regulatory reforms to reflect new market structures.

Using the example of DAOStack, Katende & Dube (2018) argue that DAOs are an efficient way of systematically conducting corporate voting, facilitating decision-making by automating tasks such as appointing CEOs, paying salaries, proposing service level agreements. Algorithmic administration by DAOs can significantly reduce transaction costs, including costs associated with the management and operation of management control systems (Kutsyket al., 2020). This degree of automation requires that different procedures for approval, confirmation, and verification, as well as the adoption of standard management decisions are standardized within the organization, and in some cases across organizations.

The amplification effects of multiple technology developments, decentralization, and disintermediation, retrofitting of digital transformation solutions, and community-driven corporate organization and governance are expected to impact the regulatory context for many industries. The risk for regulators and other policymakers is that by failing to act, other more creative jurisdictions will gain a competitive advantage in attracting the best new businesses and the most creative "talent." (Fenwick & Vermeulen 2018). Balancing the inevitable improvement in technology against these significant obstacles, Tse (2020) article predicts an incremental integration of DAOs into society through a hybrid approach, involving interim legal solutions and varying degrees of automation and decentralization.

DAOs as Transformation of Work

Working for a digitally-native organization such as a DAO may be a very different experience from current employment arrangements. Viewing social exclusion, data exploitation, surveillance, and economic inequality on the web as mainly technological problems, Zarkadakis (2021) aspires to a utopian vision of a decentralized Web 3.0 enabling new digital business models where all stakeholders and participants, including users, can share the bounty of the Fourth Industrial Revolution fairly. While blockchains, DAOs, and Web 3.0 technologies are based on decentralization of governance this neither requires, nor ensures such a utopian outcome. More pragmatically, DAOs are changing the forms and methods of management control, increasing the role of collective decisions.

This may open the way for employee initiatives or enable better individual control of work practices as individual contractors rather than employees. Accordingly, Kutsyk et al., (2020) argue that DAOs reduce the time and effort spent by managers to perform routine actions related to monitoring and control of employees' actions. Decentralization of control also reduces the impact of administrative procedures and ensures a higher level of trust within the organization. Takagi (2019) studied how blockchain may affect organizational structures and quantitatively analyses which occupations are most suitable for automation through DAOs. This quantitative analysis identified "IT experts", "Brokerage tasks", and "Information handling occupations" as the most suitable. While acknowledging the impact of automation mechanisms such as AI and Blockchain to transform the nature of work, Flood & Robb (2018) argue that professional roles still add value because the nature of the work is difficult to automate.

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While blockchain DAO technologies can certainly add functionality over time, many of the current systems are analogous to "a chat room with a shared bank account". The human participants in such arrangements may have more in common with partnership, independent contractor, or co-operative membership roles, than traditional employee roles. Whether DAOs expand to support more traditional employee roles remains to be seen. DAOS are emerging as a new research area for labor economoics (Ilyushina & Macdonald 2022).

CONCLUSION

Digital transformation involves new concepts, radical innovation, and radical organizational change across multiple organizational dimensions. Blockchains can be considered a form of digital transformation for organizations. Blockchains are associated with a decentralized implementation architecture which often contradicts centralization assumptions inherent in both IT infrastructure and in organizational processes and management structures. Blockchains also enable DAOs which may be considered as a software implementation of organizational governance, and in some cases as a legal entity. Blockchains are complex technologies which often impact business processes. Beyond a simple *technology-fit*, additional scorecards and metrics would be helpful to assess the readiness of the organization for this form of digital transformation.

Technology adaption frameworks are mostly focused on the adoption of a new technology within an organization. An aspect of the radical nature of blockchains flows from the capabilities it can provide for trustworthy transactions between organizations. This creates opportunities for new business models by disintermediation of some parties to traditional transaction flows in the same industry, or supply chain. Multiple parties must agree to adopt the new style of transactions. Scorecards and metrics for multiparty technology adoption have additional scope that metrics within a single organization do not.

Organizational readiness and maturity metrics for effectively utilizing blockchains, must address the broad range of business considerations that management should consider when evaluating opportunities for digital transformation via blockchain. Multiple proposals have been made for metrics to guide the deployments of blockchains within organizational functions and somewhat fewer in the context of interorganizational digital transformation. DAOs, as digitally-native organizations, provide a potential endpoint for organizational digitization. Readiness and maturity metrics for the deployment of new DAOs or the reorganization of existing organizations into DAOs is an area for future study.

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KEY TERMS AND DEFINITIONS

Adoption: A decision process whereby entities decide whether to use specific technologies.

Blockchain: A decentralized software technology relying on cryptographically signed transactions being validated using a consensus process.

DAO: A Decentralized Autonomous Organization provides an organizational structure whereby the DAO's administrators can direct the activities of the DAO using the blockchain smart contracts implemented in the DAO.

Directed Acyclic Graph (DAG): In graph theory, a directed acyclic graph is a directed graph with no closed loops. In the context of blockchains this is a data structure organization for the block which is in contrast to the traditional linear chain data structure of blockchains such as Bitcoin or Ethereum.

Turing-Complete: Turing completeness refers to the ability of a computer system to run any algorithm given the necessary instructions, time, and memory.

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Chapter 17
An Essay on Moligopoly Model:
A Passage to the New Frontier of Digital Economy

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ABSTRACT

This chapter has attempted to provide a strong structural foundation of the newly emerged economic model of moligopoly in the era of growing digitization. The explosive nature of digitization since the beginning of the first decade of 21st century has posed some major problems for the existing textbook economic models since they have failed to explain the market forms within which the "Big Tech" firms are operating. Going by the standard norms of non-collusive oligopoly models, these technological behemoths do not form reaction functions – although they display all the natural 'traits' of a monopolist. Thus, the new economic model of moligopoly may be defined as a hybridization of monopoly and oligopoly models, respectively. In this chapter, four major "Tech giants"; namely, Netflix, Microsoft, Facebook, and Google, are taken as sample firms for time series analysis to lay the foundation stone of moligopoly model and its related postulates.

INTRODUCTION

The idea of moligopoly evolved from the findings related to the big technological firms' business models that not only violated the traditional profit – maximization condition of the firms resulting in the derivation of *equilibrium* price and output; but simultaneously able to maintain a sustainable difference between the Marginal Revenue (MR) and Marginal Cost (MC) schedules. Hence, technically, the moligopoly model is a clear departure from the existing textbook economic models. Out of many reasons, initially *three* major reasons could be highlighted for this aberrant functioning of the major firm in digital industry, and they are: *Discontinuity*, *Modularity*, and *Uncertainty* (Petit, 2020; pp. 64 – 171).

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To quote Petit (2020, p. 121): "The tech giants operate in an environment characterized by *discontinuity*. By this, we mean changes, events, or shifts which alter the competitive environment by reallocating strategic advantages and disadvantages among firms". The sequence of historical discontinuity in digital technology may be illustrated in Table 1.

Table 1. Sequence of historical discontinuities in digital technology (Source: Petit, 2020; p. 123)

Graphical User Interfaces → Operating Systems → Portals → Search (incl search engines and online commerce) → Smartphones (incl devices, OS and Apps) → Social Networks → Cloud Computing, SaaS and ML → Home Assistants? → Augmented Reality? → Self-Driving Systems?

The concept of modularity may be defined as the economic process / processes that helps / help to combine (recombine) new products or services to the existing market at little cost (Dong et al., 2017). It is characterized by pervasiveness in the market accompanied by fierce competition to usher in random arrivals of new products and services.

According to Nambisan et al. (2017): "Most digital designs remain somewhat incomplete or in a state of flux", and as a result, "there is an unprecedented level of unpredictability and dynamism with regard to assumed structural or organizational boundaries of a digital innovation, be it a product, platform or service". Finally, the *uncertainty* factor of the digital economy is rooted in the fact that the firms are uncertain about the behaviors of their competitors. According to Petit (2020, p. 123): "Many big tech firms did not correctly anticipate the trends of the next generation of digital information technology. In the early 21st century, Microsoft adopted an approach to the Internet focused on control of content and networks, not search engines. Until 2004, Netflix had reservations about the potential of streaming over DVD. In 2012, Facebook expressed reservations about mobile ads monetization, arguably given screen and user attention constraints". Moreover, in case of the *entry* factor, the big technological firms are quite apprehensive about the level of competition and entry of smaller but efficient firms in the market. As per the 10 – K, US SEC Report (1996); Microsoft declared that the "extremely rapid pace of technological change constantly creates new opportunities for existing competitors and start- ups and can quickly render existing technologies less valuable"[1], and according to the 10 – K, US SEC Report (2009); Google stated that "Emerging start- ups may be able to innovate and provide products and services faster than we can"[2] . Now as per the standard textbook definition of monopoly, a monopolistic market is characterized by the features of a *single* seller who enjoys the power of price discrimination, lack of close *substitutes*, and a high barrier to entry (Bilas, 1979). In case of digital economy, it is *not* a single seller, rather a *motley* of sellers operating in distinguished domains of ICT sector control the market, and they *do* enjoy the power of price discrimination to attract an extremely large pool of consumers. Apart from few exceptions like Amazon®, Alibaba®, Netflix®, and Amazon Prime®; big tech firms usually do not sell close substitutes. In those cases, the firms in question follow the oligopoly model, and tend to offer their *own* products / services within a specific price – band withstanding the concept of *reaction*

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curves (Bilas, 1979) of their competitors – which, in fact, stands in contrast to one of the major features of non – collusive oligopoly.

Although Petit (2020) introduced the moligopoly model in the literature of economic theory, his work lacked the structural foundation of the said model in a concrete manner. More precisely, the basic quantitative modeling which is required for establishing any fundamental economic model – was completely missing. Hence the primary objective of this article is to plug that gap between the theory and application, and simultaneously supplement the existing model with the necessary mathematical framework for further logical explanations related to moligopolistic models in the real-world scenario. In this context, this research work should be treated as the *first feasible structured economic model* of moligopoly.

Since the essence of moligopoly model is based on the combination of selective features of monopoly and oligopoly models of market, the major features of moligopoly model may be noted as follows:

1. Marginal Revenue (MR) and Marginal Cost (MC) curves do *not* intersect,
2. Marginal Revenue (MR) is greater than the Marginal Cost (MC) for the firms under digital economy,
3. Absence of *equilibrium* point leading to failure of derivation of *optimal* price and output for the firms in this sector,
4. The rate of growth of Marginal Cost (MC) is *lesser* than the rate of growth of Marginal Revenue (MR),
5. Absence of *reaction curves / functions* for the competitors,
6. Firms usually operate within a *price bound*, say, p_l and p_u, where p_l = Lower bound price, and p_u = Upper bound price. The market is segmented according to consumer preferences, and
7. The Gross Profit (π), Revenue (R), and Cost of Sales / Cost (C) functions are dependent on the Number of consumers (N) (which include the number of subscribers and patrons combined) since the output produced (q) by the firm is directly proportional to the Number of consumers (N).

In order to lay a strong foundation of the moligopoly model based on quantitative approach, the validity of the features / assumptions is empirically tested by mathematical modelling and time series study for the time period of 20 years (2001 – 2020), 26 years (1995 – 2020), 11 years (2010 – 2020), and 8 years (2013 – 2020) for 4 major moligopolistic tech firms Netflix®, Microsoft®, Facebook®, and Google® respectively.

LITERATURE REVIEW

Since the explosion of digitization in the first decade of 21st century, the concepts of *digital entrepreneurship* and *sharing economy* had come to the fore. Sussan and Acs (2017, p. 66) have defined a digital entrepreneur as "any agent that is engaged in any venture; be it commercial, social, government, or corporate that uses digital technologies".

Hull *et al*. (2007) have categorized digital entrepreneurs into three types: (i) The first entrepreneur is of 'click and mortar' type who tries to complement his conventional business venture by digital products and services, (ii) The second entrepreneur depends on the integration of digital technologies in the value chain, and (iii) The third entrepreneur refers to the entire digital venture. On the other hand, the *sharing economy* may be defined as the market place which consists of consumers of goods and services dependent on platforms like websites and apps that "enable, facilitate and mediate exchanges and sharing

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between peers to create alternate and stable marketplaces (Rivera *et al*., 2017; p. 12)" or "activities or platforms which facilitate the sharing of material, products, product services, space, money, workforce, knowledge, or information based on for-profit or non-profit transactions in a variety of different market structures (Plewnia and Guenther, 2018; p. 576)".

Between the time period of 5 years (2020 – 2025), global E-Commerce sales is expected to increase by 47 percent from $2.9 billion to $4 billion where Asia's growth rate of 51 percent will surpass the global growth rate (from $1.7 billion to $2.5 billion) (Figure 1).

Figure 1. Projected E-Commerce Sales in selected countries/regions
Source: Statista Digital Market Outlook (URL: www.statista.com)



According to Vinogradov et al. (2022; p. 4), there are *at least* three approaches which *contextualize* the potential of sharing economy as follows:

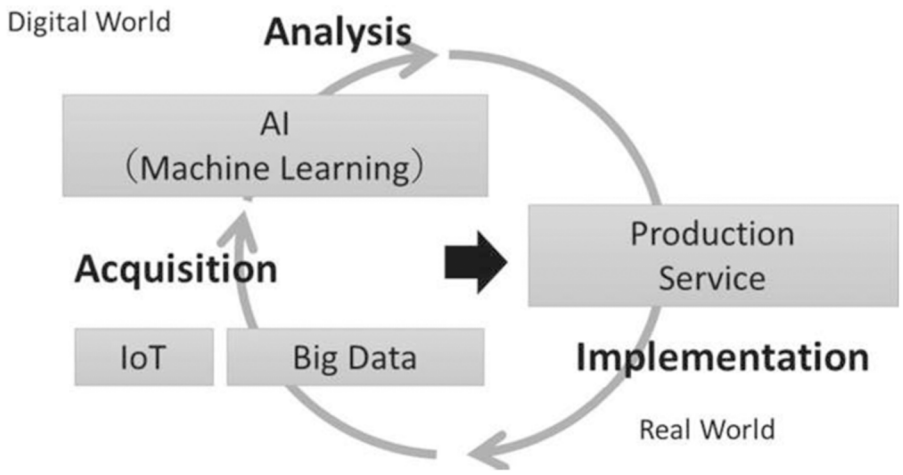
1. First, entrepreneurship in the digital age incorporates various elements of entrepreneurship including the creation of new digital business ventures in the sharing economy;

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2. Second, digital entrepreneurship is, moreover, taking place through the exploitation of existing sharing-economy platforms. In this case, platforms that are already established represent a key element of a novel business; and
3. Third, the new digital entrepreneurship opportunities are most likely to embrace disruptive activities in existing business models and practices along with the creation of new ventures. Established businesses are challenged through the advent of the platform- based sharing economy and will be increasingly pressurized to adapt their existing business models in order to prevent them from becoming obsolete.

The most beneficial feature of digital economy is minimization of transaction costs through *disintermediation* (Vinogradov et al., 2022; p. 5) by which all the intermediaries (middlemen) are removed from the value chain. The digital infrastructure has allowed start – up entrepreneurs to ensure entrepreneurial activities in a smarter and expeditious way (Standing and Mattsson, 2018) supported by a strong demand – side network effects (Apte and Davis, 2019; Parker et al., 2016). To quote Takeda (2021; p. 3): "The consumers' demands are usually not visible and grow/change during the use of new products and services. Circulations that connect users and creators that enable creating new products/services that reflect the ever-changing or unconstructed users' demands well are indeed the essential social value creation processes". The Real-World Data Circulation (RWDC) paradigm (Takeda, 2021) may be illustrated as in Figure 2.

Figure 2. The RWDC process is indispensable in order to transform the production process and/or consumer services using digital technologies
Source: Takeda (2021; p. 4)



The modern ICTs (Information and Communication Technologies) are treated by economists as "General Purpose Technologies (GPT)" (Mansell et al., 2009, p. 7).

Bekar and Haswell (2013, p. 10) have defined "'Digital ICT' as the collection of components embodying electronic binary logic. The definition includes PCs, tablets, phones and other smart devices,

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and the software running on those devices. It includes the Internet and devices connected to the Internet. Digital ICTs are often characterized by clusters of computing systems embodied in a range of components with high degrees of connectivity". However, contrary to the major "time – saving" feature associated with digitization, the levels of service are prone to decline in quality if there are reductions in time and effort, e.g., live performing arts, health care, education etc. which is termed as Baumol's *cost disease* (Baumol, 2013, p. 10). Pratt (2013, p. 43) have argued that "spatial-technological dualism is the wrong way to frame the debate about the digital creative economy. In contrast, what I have argued in this chapter is that this relationship is better conceived of as a complex amalgam of the online and offline, of the digital and analogue, which are materialized in various ways in particular spaces, which in turn constitutes them as 'places'".

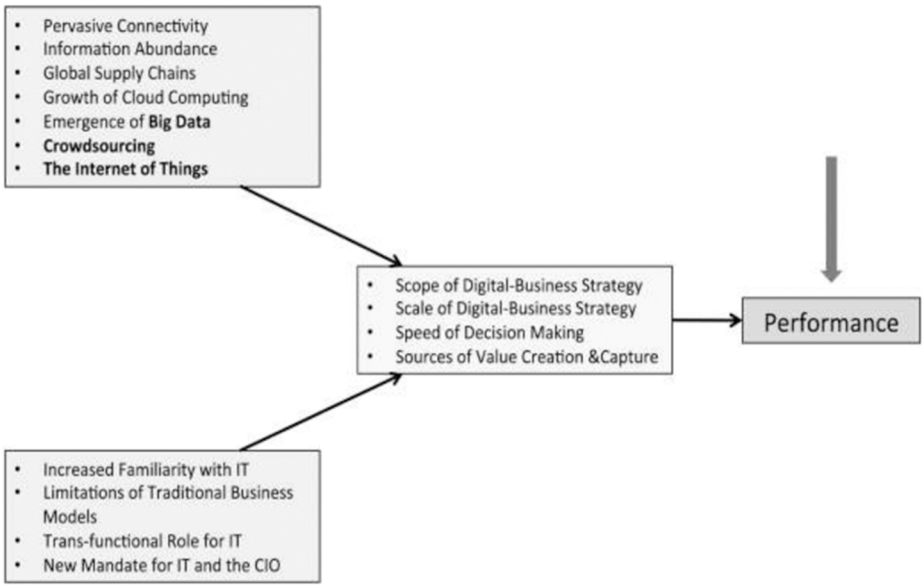
The properties of digital economy may be illustrated as follows: "Digital economy builds on the basis of the internet economy – it takes computerisation, automation, and internet connectedness to the next level of ubiquitous computing via digital devices, intelligent automation everywhere, and platformisation. It is also characterised by the extraordinary pace of innovation (Śledziewska and Włoch, 2021; p. 22)".

Cusumano (2010; p. 33) has noted that the most distinguishing feature of digital industry platforms and ecosystems is their "creation of 'network effects'" and positive-feedback-based skew distributions.

According to McKelvey (2021, pp. 18 - 19), there are some major digital-speed effects which frequently help to develop new-order creations. Some of the digital-speed effects are *Digital tension effects*, *Digital effects in the region of emergence*, and *Digital effects on fractal and power – law distributions*.

The drivers of four *key* elements of Digital-Business (DB) strategy which lead to better performance for the organization may be illustrated as Figure 3.

Figure 3. The drivers of four key elements of Digital-Business (DB) strategy which lead to better performance
Source: Bharadwaj et al. (2013)



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The rise of the 'Big Tech' moligopolists in the global scenario has called for appropriate implementation of Antitrust laws. Petit (2020, p. 238) has iterated that these big tech firms are characterized by *three* inherent *novel harms*, i.e., *privacy*, *fake news and hate speech*, and *models of regulation*. To quote the author: "The truth is that several tech giants use business models adverse to privacy. Google, Facebook, and perhaps to a lesser extent Microsoft and Amazon, generate substantial revenue by showing targeted advertisement ("ads") to users. Targeted ads reduce privacy at more than one level. To start, targeted ads require extraction of personal data".

Hate speech and fake news are two other novel harms which are propagated by the major tech films like Google and Facebook without fearing about the consequences.

The model of regulation involves consumer protection laws which "cover a diverse collection of rules, including advertisement regulation, rights to mandatory contract provisions and pro- consumer interpretation, and product design obligations intended to effectuate real consumer choice".

Thus, to sum up, there is an urgent need of studying the 'conceived' moligopoly model in the times of digital entrepreneurship and sharing economy with an emphasis on the functioning of the "Big Tech" firms in particular.

Structural Modelling of Moligopoly

By keeping in mind, the basic features of a moligopoly market, the structural framework of a moligopoly model may be expressed as follows:

1. Revenue function: $R_i = \sum_{i=1}^{n} p_i N_i$
   where R_i = Revenue earned from segment i (i = 1, 2, …., n),
   p_i = Price charged in segment i (i = 1, 2, …., n), and
   N_i = Number of consumers in segment i (i = 1, 2, …., n);
2. Cost function: $C_i = C_i(N_i)$
   where C_i = Cost borne by the firm in segment i (i = 1, 2, …..., n);
3. Since Marginal Revenue (MR) of the firm is greater than its Marginal Cost (MC), hence formally, let $MR = \lambda \times MC$ with $\lambda > 1$.
   As per assumption, we have: $p = p(N)$ with $p' \leq 0$

Hence

$$R = \int_{p_l}^{p_u} Np(N)\,dN = N\int_{p_l}^{p_u} p(N)\,dN - \int\left[\left[\frac{d(N)}{dN}\right]\int_{p_l}^{p_u} p(N)\,dN\right]dN$$

$$\rightarrow R = N\left[p_u(N) - p_l(N)\right] - \int\left[p_u(N) - p_l(N)\right]dN \quad (1)$$

$$\rightarrow R = Ng(N) - \int g(N)\,dN = Ng(N) - G(N) - K$$

where $g(N) = p_u(N) - p_l(N)$, $G(N) = \int g(N)dN$, and K = Constant of integration. Now

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$$MR = g(N) + Ng'(N) - g(N) = Ng'(N) \rightarrow MR = N(p_u' - p_l')$$

since $g(N)=p_u - p_l$ and $g'(N) = p_u' - p_l'$
Now since by assumption, $MR=\lambda\times MC$, hence it follows:

$$N(p_u' - p_l') = \lambda MC \rightarrow \frac{N(p_u' - p_l')}{MC} = \lambda \quad (2)$$

where λ = Index of moligopoly power, and

$$p_u' = \frac{\partial p_u}{\partial N}, \; p_l' = \frac{\partial p_l}{\partial N}.$$

(p_u= Upper bound price, p_l= Lower bound price)

When p_l=0, then $p_l' = 0$; and it leads to the scenario of *absolute monopolistic control* of the firm in the moligopoly market. A prime example would be the case of Facebook where the said firm enjoys absolute control over the market by giving a wide range of *free benefits* to its huge base of basic subscribers by virtue of its free social networking accounts, e.g., Facebook Messenger®, WhatsApp®, Instagram®, Facetime® services etc.
Hence $\lambda=\lambda max$ when $p_l' = 0$.

In other words, $\lambda^{max} = \frac{Np_u'}{MC}$ (2a)

Now, let us attempt to explore the natures of the Index of moligopoly power (λ) in real word scenario for two competing moligopolistic firms Netflix® and Amazon Prime Video® that sell *homogeneous* products like movies, documentaries, web – series etc. by following monopolistic price discrimination strategy.

Comparative Study Between Netflix and Amazon Prime Video

Case 1: Netflix®

Netflix charges 3 different prices to its consumers under Basic, Standard and Premium Plans of US$ 8.99, 13.99, and 17.99 per month respectively. Hence the pricing policy of this firm pertains to *second - degree price discrimination* where the firm receives a larger part of *consumers' surplus* compared to *third – degree price discrimination* (Koutsoyiannis, 1979). Now for Netflix, according to the prior assumption of the structural model:

Lower price bound (p_l) = \$8.99 per month, and Upper price bound (p_u) = \$17.99 per month.[3]

Now let $D = p_u - p_l = \$9.00 = \overline{D}$ (Fixed).

When the difference between the upper and lower limits of prices becomes fixed, then equation: (2) changes into the following:

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$$\lambda = \frac{N \times \overline{D}}{MC} \rightarrow N\overline{D} = \lambda MC \tag{3}$$

Now differentiating equation: (3) with respect to N, we have:

$$\overline{D} = MC\frac{d\lambda}{dN} + \lambda\frac{dMC}{dN} \rightarrow \overline{D} = \frac{dC}{dN} \times \frac{d\lambda}{dN} + \frac{\lambda d^2C}{dN^2} \tag{4}$$

[Since $MC = \frac{dC}{dN}$ and $\frac{dMC}{dN} = \frac{d^2C}{dN^2}$]

Equation (4) is a differential equation of *first – order and first – degree* (Das and Mukherjee, 2000). In order to solve equation: (4), let $C=e^{mN}(N\neq 0)$.

Hence $\frac{dC}{dN} = me^{mN}$ and $\frac{d^2C}{dN^2} = m^2e^{mN}$

Now by substituting the values of $\frac{dC}{dN}$ and $\frac{d^2C}{dN^2}$ in equation: (4), the following results may be obtained:

$$me^{mN}\left[\frac{d\lambda}{dN} + m\lambda\right] = \overline{D}$$

$$\rightarrow \frac{d\lambda}{dN} + m\lambda = \frac{\overline{D}}{me^{mN}}$$

$$\rightarrow \lambda = e^{-\int mdN}\left[\int \frac{\overline{D}}{me^{mN}} e^{\int mdN} dN\right] + \psi$$

$$\rightarrow \lambda = e^{-mN}\left[\int \frac{\overline{D}}{me^{mN}} e^{mN} dN\right] + \psi$$

$$\rightarrow \lambda = e^{-mN}\left[\frac{\overline{D}}{me^{mN}} \cdot \frac{e^{mN}}{m}\right] + \psi$$

$$\rightarrow \lambda = \frac{\overline{D}e^{-mN}}{m^2} + \psi \tag{5}$$

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where ψ = Constant of integration.

Since as per derivation, $\overline{D} = 9$ for Netflix; hence the index of moligopoly power (λ) for Netflix may be estimated by the equation as follows:

$$\lambda = \frac{9e^{-mN}}{m^2} + \psi \tag{6}$$

Case 2: Amazon Prime Video®

Contrary to the pricing model followed by Netflix®, Amazon Prime Video® adopts a *unique* price modelling of $8.99 per month (plus taxes).[4]

Hence for Amazon Prime Video, price (p) = 8.99 = p^0 (Fixed)

In order to simplify the way of estimating λ for any moligopolistic firm, the required *generalized* equation may be expressed as:

$$\lambda = \frac{\tilde{p} \times N}{MC} \tag{7}$$

where $\tilde{p}$ = Either the difference between upper and lower price bounds ($p_u - p_l$) or a fixed price (p^0) depending on the price discrimination strategy adopted by the firm.

By following equation: (7), Netflix's index of moligopoly power may be expressed as:

$$\lambda = \frac{9 \times N}{MC} \text{ (8);}$$

and Amazon Prime Video's index of moligopoly power as:

$$\lambda = \frac{8.99 \times N}{MC} \tag{9}$$

An overview of equations: (8) and (9) provides an idea that $\lambda_{NFLX} \approx \lambda_{AMZN}$ (where λ_{NFLX} = Index of moligopoly power of Netflix, and λ_{AMZN} = Index of moligopoly power of Amazon Prime Video respectively) under the assumptions that the numbers of subscribers (N) and marginal costs (MC) for both the firms are equal. However, an introspection of those two equations indicates that actually the ratio of subscribers to marginal cost ($\frac{N}{MC}$) plays the pivotal role in determining the extent of moligopolistic power in the market.

The other important point which should be noted is that since Amazon Prime Video has adopted *first - degree price discrimination policy*, i.e., "take it or leave it" price – discrimination; in comparison to Netflix, it will gain much larger share of consumers' surplus as under first - degree price discrimination, the said firm's share of consumers' surplus is *largest* (Koutsoyiannis, 1979).

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Finally, recalling equation: (5), we have:

$$\lambda = \frac{\overline{D}e^{-mN}}{m^2} + \psi$$

By differentiating equation: (5) with respect to N, the following result may be obtained:

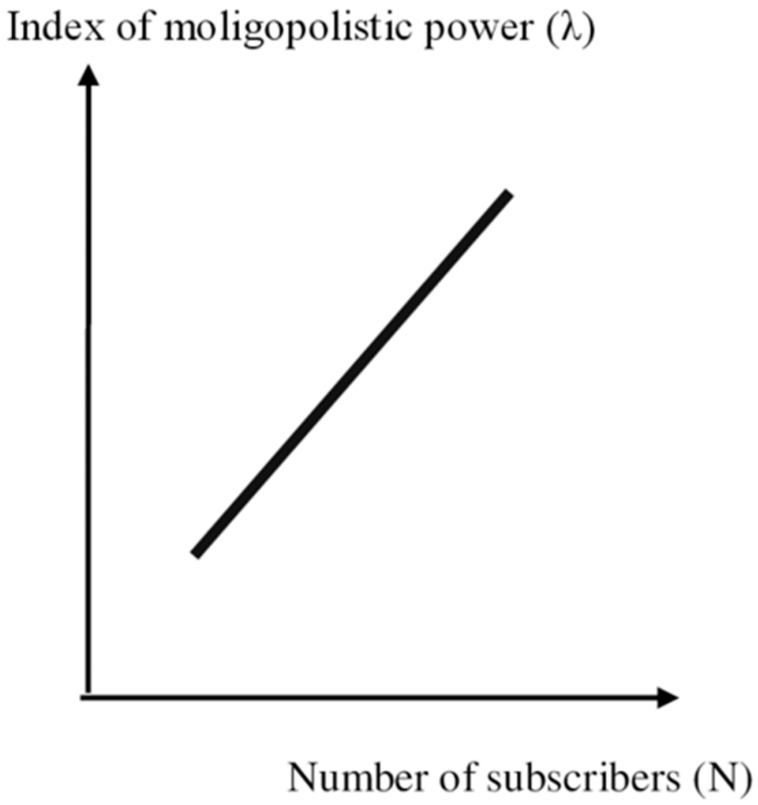
$$\frac{d\lambda}{dN} = -m \times \frac{\overline{D}e^{-mN}}{m^2} = -\frac{\overline{D}e^{-mN}}{m} > 0 \; or \; < 0$$

depending on m < 0 or m > 0; and

$$\frac{d^2\lambda}{dN^2} = \overline{D}e^{-mN} > 0$$

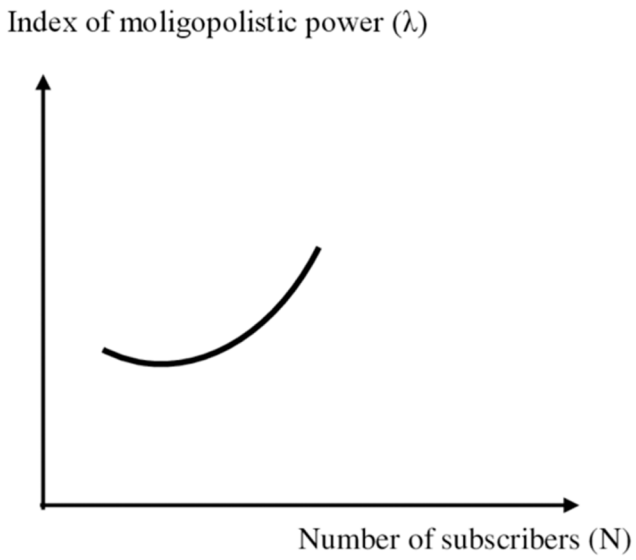
Thus it proves the fact that the index of moligopolistic power (λ) curve is *either* rising (Refer to Figure 4(a)) *or* U – shaped in nature. In the short run, the moligopolistic firm might find its index of moligopolistic power falling, however, in the long run it starts increasing as in Figure 4(b).

Figure 4a. Index of moligopolistic power curve (m < 0)



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Figure 4b. Index of moligopolistic power curve (m > 0)



Quest for an Equilibrium Condition in Moligopoly

As discussed earlier, under moligopolistic market structure, an equilibrium condition *cannot* be derived as the Marginal Revenue (MR) function always *exceeds* the Marginal Cost (MC) function of the firm in the finite space of time. Hence initiating a departure from the traditional model of imperfect competition, the basic structural transformation in case of the moligopoly market may be illustrated as follows:

- The Revenue / Sales (R) function may be expressed as an *integral* of an exponential function for the time period t (t = 1, 2, ……, T);
- Similarly, the Cost of Sales / Cost (C) function is also expressed as an *integral* of an exponential function for the time period t (t = 1, 2, ……, T).

Formally,

$$R_t = R_0 \int_{t=1}^{T} e^{\alpha t} dt \tag{10}$$

and

$$C_t = C_0 \int_{t=1}^{T} e^{\beta t} dt \tag{11}$$

where R_t= Revenue in time t;
C_t= Cost in time t;
R_0= Revenue in time 0;

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C_0= Cost in time 0;
α= Revenue coefficient; and
β= Cost coefficient ($\alpha, \beta > 0$).
Thus technically,

$$R_t = R_0\left[\frac{e^{\alpha t}}{\alpha}\right]_1^T = \frac{R_0 e^{\alpha}}{\alpha}\left[e^{\alpha(T-1)} - 1\right]$$

and

$$C_t = C_0\left[\frac{e^{\beta t}}{\beta}\right]_1^T = \frac{C_0 e^{\beta}}{\beta}\left[e^{\beta(T-1)} - 1\right].$$

Now the (Gross) Profit function in time t may be expressed as:

$$\begin{aligned} \pi_t &= R_t - C_t = \frac{R_0 e^{\alpha}}{\alpha}\left[e^{\alpha(T-1)} - 1\right] - \frac{C_0 e^{\beta}}{\beta}\left[e^{\beta(T-1)} - 1\right] \\ \Rightarrow \pi_t &= \frac{R_0}{\alpha}\left[e^{\alpha T} - e^{\alpha}\right] - \frac{C_0}{\beta}\left[e^{\beta T} - e^{\beta}\right] \end{aligned} \tag{12}$$

The necessary first order conditions for profit maximization require:

$$\frac{\partial \pi_t}{\partial \alpha} = \frac{R_0}{\alpha}\left[Te^{\alpha T} - e^{\alpha}\right] = 0 \tag{13}$$

and

$$\frac{\partial \pi_t}{\partial \beta} = -\frac{C_0}{\beta}\left[Te^{\beta T} - e^{\beta}\right] = 0 \tag{14}$$

By simplifying equations: (13) and (14), we have:

$$Te^{\alpha T} - e^{\alpha} = 0 \text{ [Since } \frac{R_0}{\alpha}, \frac{C_0}{\beta} > 0]$$

$$\Rightarrow \frac{e^{\alpha T}}{e^{\alpha}} = \frac{1}{T}$$

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$$\Rightarrow e^{\alpha(T-1)} = \frac{1}{T}$$

$$\Rightarrow \alpha^* = \left(\frac{1}{T-1}\right) e^{\frac{1}{T}};$$

and similarly

$$\beta^* = \left(\frac{1}{T-1}\right) e^{\frac{1}{T}}$$

where α^* and β^* [a]re op*timal v*alues of revenue and cost coefficients respectively.

Thus, as per the m*arginalist rule* of profit maximization, a moligopolist will attain his / her e*quilibrium,* if and only if, the following condition is met:

$$\alpha^* = \beta^* = \left(\frac{1}{T-1}\right) e^{\frac{1}{T}} \tag{15}$$

Equation: (13) may be treated as the *sufficient and necessary condition* for attaining equilibrium in moligopolistic market under the *apparently improbable* assumption that the MR and MC curves *might* intersect at some point of time.

RESULTS AND FINDINGS

The estimations of (Gross) Profit (π) for the 4 sample moligopolistic firms, i.e., Netflix, Microsoft, Facebook, and Google (Alphabet Inc.) are done by calculating the differences between their respective Revenue (R) and Cost (C) schedules (Refer to Tables 2, 3, 4, and 5 respectively).

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Table 2. Estimation of (gross) profit for Netflix (2001 – 2020)

Year	Sales (R)	Cost of Sales (C)	Gross Profit (π)
2001	75,912	49,907	26,005
2002	1,52,806	78,136	74,670
2003	2,70,410	1,79,010	91,400
2004	5,00,611	3,31,712	1,68,899
2005	6,82,213	4,65,775	2,16,438
2006	9,96,660	6,26,985	3,69,675
2007	12,05,340	7,86,168	4,19,172
2008	13,64,661	9,10,234	4,54,427
2009	16,70,269	10,79,271	5,90,998
2010	21,62,625	13,57,355	8,05,270
2011	32,04,577	20,39,901	11,64,676
2012	36,09,282	26,25,866	9,83,416
2013	43,74,562	30,83,256	12,91,306
2014	55,04,656	37,52,760	17,51,896
2015	67,79,511	45,91,476	21,88,035
2016	88,30,669	60,29,901	28,00,768
2017	1,16,92,713	76,59,666	40,33,047
2018	1,57,94,341	99,67,538	58,26,803
2019	2,01,56,447	1,24,40,213	77,16,234
2020	2,49,96,056	1,52,76,319	97,19,737

Table 3. Estimation of (gross) profit for Microsoft (1995 – 2020)

Year	Sales (R)	Cost of Sales (C)	Gross Profit (π)
1995	5,937	877	5,060
1996	8,671	1,188	7,483
1997	11,358	1,085	10,273
1998	15,262	2,460	12,802
1999	19,747	2,814	16,933
2000	22,956	3,002	19,954
2001	25,296	3,455	21,841
2002	28,365	5,699	22,666
2003	32,187	6,059	26,128
2004	36,835	6,596	30,239
2005	39,788	6,031	33,757
2006	44,282	7,650	36,632
2007	51,122	10,693	40,429
2008	60,420	11,598	48,822
2009	58,437	12,155	46,282
2010	62,484	12,395	50,089
2011	69,943	15,577	54,366
2012	73,723	17,530	56,193
2013	77,849	20,249	57,600
2014	86,833	27,078	59,755
2015	93,580	33,038	60,542
2016	91,154	32,780	58,374
2017	96,571	34,261	62,310
2018	1,10,360	38,353	72,007
2019	1,25,843	42,910	82,933
2020	1,43,015	46,078	96,937

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Table 4. Estimation of (gross) profit for Facebook (2010 – 2020)

Year	Sales (R)	Cost of Sales (C)	Gross Profit (π)
2010	1,974	493	1,481
2011	3,711	860	2,851
2012	5,089	1,364	3,725
2013	7,872	1,875	5,997
2014	12,466	2,153	10,313
2015	17,928	2,867	15,061
2016	27,638	3,789	23,849
2017	40,653	5,454	35,199
2018	55,838	9,355	46,483
2019	70,697	12,770	57,927
2020	85,965	16,692	69,273

Table 5. Estimation of (gross) profit for Google (2013 – 2020)

Year	Sales (R)	Cost of Sales (C)	Gross Profit (π)
2013	55519	21993	33526
2014	66001	25691	40310
2015	74989	28164	46825
2016	90272	35138	55134
2017	110855	45583	65272
2018	136819	59549	77270
2019	161857	71896	89961
2020	182527	84732	97795

Netflix®

The regression equation of Cost (C) on Revenue (R) for the time period of 20 years (2001 – 2020) may be illustrated as follows (Refer to Table 6):

$$C(N) = 139146 + 0.62R(N) \tag{16}$$

By differentiating equation: (16) with respect to number of subscribers (N), the following result may be obtained:

$$\frac{dC}{dN} = 0.62\frac{dR}{dN}$$

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Table 6. The regression equation of Cost (C) on Revenue (R) for Netflix (2001 – 2020) [X Variable 1: Revenue (R)]

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.9989613
R Square	0.9979237
Adjusted R Square	0.9978084
Standard Error	207862.04
Observations	20

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	3.73796E+14	3.73796E+14	8651.36	1.33122E-25
Residual	18	7.77719E+11	43206626035		
Total	19	3.74574E+14			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	139145.6	59988.09416	2.319553687	0.03232	13115.29581	265175.91	13115.29581	265175.914
X Variable 1	0.6187148	0.006651938	93.01271325	1.3E-25	0.604739613	0.63269	0.604739613	0.63269002

$\Rightarrow MC = 0.62\, MR$

$\Rightarrow MR = 1.61\, MC$

$$\Rightarrow \frac{MR}{MC} = 1.61 \tag{17}$$

Hence the Index of Moligopoly Power for Netflix (λ_{NFLX}) = 1.61

Now by recalling equation: (3), we have:

$$N\overline{D} = \lambda MC$$

By substituting the values of $\overline{D} = 9$ and $\lambda = 1.61$ in the equation above, we get:

$$9N = 1.61MC \Rightarrow N^{*} = 0.18MC \tag{18}$$

where N* = Optimal number of consumers.

Thus the *optimal* number of consumers for Netflix is approximately 18 percent of its marginal cost.

The next stage of analysis involves derivation of Netflix's *functional domains* of (Gross) Profits (π) with respect to its Revenue (R) and Cost (C) respectively. The required regression result of (Gross) Profit (π) on Revenue (R) is as follows (Refer to Table 7):

$$\pi(R) = -139146 + 0.38R \tag{19}$$

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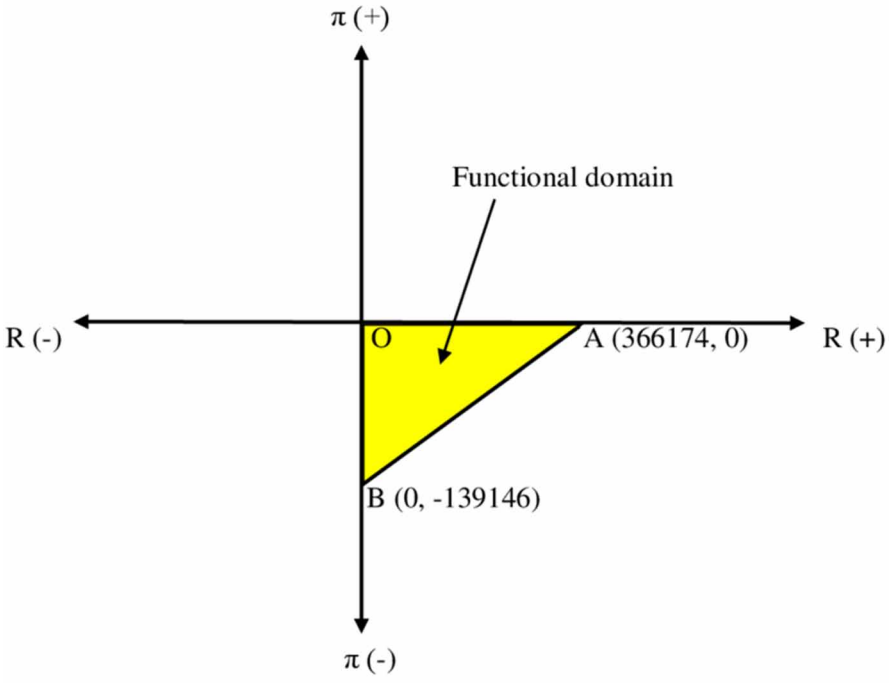
Table 7. The regression equation of (Gross) Profit (π) on Revenue (R) for Netflix (2001 – 2020) [X Variable 1: Revenue (R)]

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.9972719							
R Square	0.9945513							
Adjusted R Square	0.9942486							
Standard Error	207862.04							
Observations	20							
ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	1	1.41956E+14	1.41956E+14	3285.51	7.87061E-22			
Residual	18	7.77719E+11	43206626035					
Total	19	1.42734E+14						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-139145.6	59988.09416	-2.31955369	0.03232	-265175.9141	-13115.3	-265175.914	-13115.296
X Variable 1	0.3812852	0.006651938	57.31941182	7.9E-22	0.36730998	0.3952604	0.36730998	0.39526039

Now, $\lim_{R\to 0+} \pi(R) = -139146 + 0 = -139146$ and $\lim_{R\to 366174} \pi(R) = 0$.

Therefore, Netflix's functional domain of (Gross) Profit (π) with respect to its Revenue (R) may be plotted as in Figure 5.

Figure 5. Netflix's functional domain of (Gross) Profit (π) with respect to its Revenue (R)



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Table 8. The regression equation of (Gross) Profit (π) on Cost (C) for Netflix (2001 – 2020) [X Variable 1: Cost (C)]

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.9928726
R Square	0.9857959
Adjusted R Square	0.9850068
Standard Error	335608.8
Observations	20

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1.40706E+14	1.40706E+14	1249.24	4.3932E-18
Residual	18	2.0274E+12	1.12633E+11		
Total	19	1.42734E+14			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-212590.3	98357.30255	-2.16140869	0.04438	-419231.35	-5949.304	-419231.353	-5949.30362
X Variable 1	0.6128977	0.017340616	35.3446345	4.4E-18	0.57646645	0.649329	0.576466447	0.649329011

Now the required regression result of (Gross) Profit (π) on Cost (C) would be (Refer to Table 8):

$$\pi(C) = -212590 + 0.62C \tag{20}$$

Similarly, $\lim_{C \to 0+} \pi(C) = -212590 + 0 = -212590$ and $\lim_{C \to 342887} \pi(C) = 0$.

In a similar fashion as described above, Netflix's functional domain of (Gross) Profit (π) with respect to its Cost (C) may be plotted as in Figure 6.
Formally, to sum up:

$\pi(R) > 0$ when $R > 366174$;
$\pi(R) = 0$ when $R = 366174$; and
$\pi(R) < 0$ when $R < 366174$.

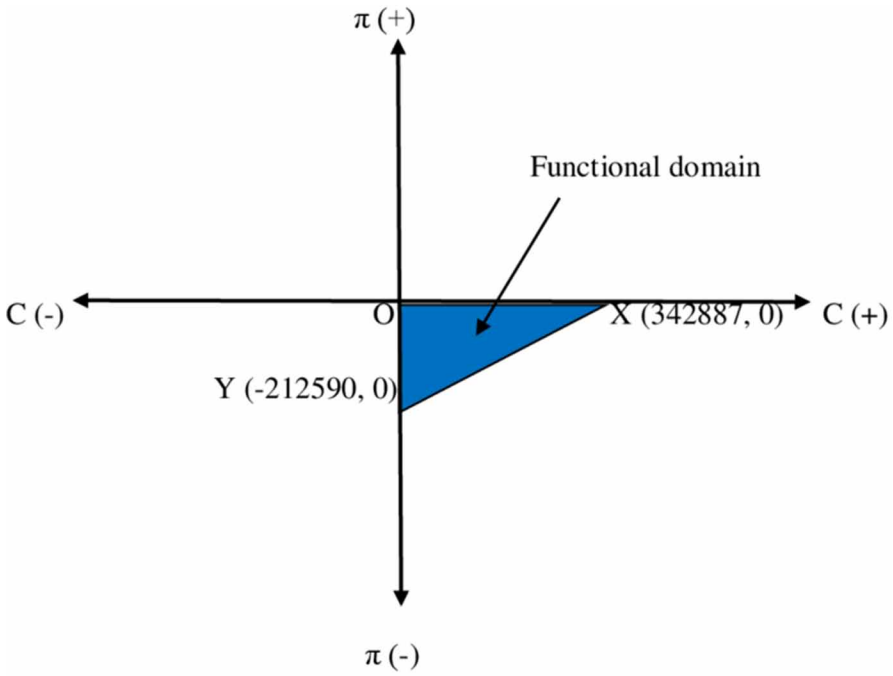
Similarly,

$\pi(C) > 0$ when $C > 342887$;
$\pi(C) = 0$ when $C = 342887$; and
$\pi(C) < 0$ when $C < 342887$.

Clearly, the profit function of Netflix is a *positive monotonic transformation* of both of its revenue and cost functions simultaneously.

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Figure 6. Netflix's functional domain of (Gross) Profit (p) with respect to its Cost (C)



Microsoft®

The regression equation of Cost (C) on Revenue (R) for the time period of 26 years (1995 – 2020) may be illustrated as follows (Refer to Table 9):

$$C(N) = -5654 + 0.37R(N) \tag{21}$$

By differentiating equation: (21) with respect to number of subscribers (N), the following result may be obtained:

$$\frac{dC}{dN} = 0.37\frac{dR}{dN}$$

$$\Rightarrow MC = 0.37MR$$

$$\Rightarrow MR = 2.7MC$$

$$\Rightarrow \frac{MR}{MC} = 2.7 \tag{22}$$

Thus the Index of Moligopoly Power for Microsoft (λ_{MSFT}) = 2.7

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Table 9. The regression equation of Cost (C) on Revenue (R) for Microsoft (1995 – 2020) [X Variable 1: Revenue (R)]

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.974137004
R Square	0.948942903
Adjusted R Square	0.946815524
Standard Error	3281.269122
Observations	26

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	4802627603	4802627603	446.062	5.18168E-17
Residual	24	258401449.3	10766727.1		
Total	25	5061029052			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-5653.66654	1188.367752	-4.7575059	7.7E-05	-8106.337038	-3200.9961	-8106.33704	-3200.99605
X Variable 1	0.367694177	0.017409614	21.1201795	5.2E-17	0.331762499	0.4036259	0.3317625	0.403625854

Microsoft's pricing model is broadly divided into 2 categories, i.e.; pricing model for *home* consumers, and pricing model for *business* consumers. The range of pricing for business consumers is obviously greater than that of for home consumers.

For *home* consumers, Microsoft follows *second – degree price discrimination* (Koutsoyiannis, 1979) by charging 2 prices of *Microsoft 365 Personal* and *Microsoft 365 Family* for US$6.99 and 9.99 per month respectively. Since under the second – degree price discrimination policy, the consumers' surplus is *least* affected; hence its home consumers are somehow "better-off" as compared to the consumers of Netflix.

On the other hand, for *business* consumers, Microsoft follows *third – degree price discrimination* (Koutsoyiannis, 1979) by charging 4 prices of *Microsoft 365 Business Basic*, *Microsoft 365 Business Standard*, *Microsoft 365 Business Premium*, and *Microsoft 365 Apps for business* for US$5.00, 12.50, 20.00, and 8.25 per month respectively.[5]

Hence Microsoft takes away more of consumers' surplus for its business consumers, and predictably so, since it applies third – degree price discrimination policy for its business consumers to garner more profits from this section.

Since Microsoft divides its consumer base into *two* broad categories, i.e., home consumers and business consumers respectively; hence we may express it as follows:

$$N_1 + N_2 = N$$

where N_1= Number of home consumers and N_2= Number of business consumers.

Now by recalling equation: (7), it may be written that:

$\tilde{p_1} = 9.99 - 6.99 = 3$ = Difference between the upper and lower bound prices for the home consumers

and

$\tilde{p_2} = 20 - 5 = 15$ = Difference between the upper and lower bound prices for the business consumers.

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Thus, the equation for Microsoft's index of moligopoly power may be written as below:

$$\begin{aligned} & \tilde{p_1} N_1 + \tilde{p_2} N_2 = \lambda MC \\ & \Rightarrow 3N_1 + 15N_2 = \lambda MC \\ & \Rightarrow \lambda = \frac{3N_1 + 15N_2}{MC} \end{aligned} \tag{23}$$

Now by plugging the value of λ from equation: (22) into equation: (23), we have:

$$\begin{aligned} & \frac{3N_1 + 15N_2}{MC} = 2.7 \\ & \Rightarrow \frac{N_1 + 5N_2}{MC} = 0.9 \\ & \Rightarrow \frac{N_1}{MC} + \frac{5N_2}{MC} = 0.9 \end{aligned} \tag{24}$$

If we treat ($\frac{N_1}{MC}$) and ($\frac{N_2}{MC}$) as two separate variables, i.e., let $\frac{N_1}{MC} = x$ and $\frac{N_2}{MC} = y$; then equation: (24) would take the form as below:

$$x + 5y = 0.9$$

In order to find the graphical solutions for the equation above, the following sets of feasible solutions are acceptable by keeping in mind the *nonnegativity* conditions of both x and y as shown in Table 10.

Table 10. Some of the feasible sets of solutions for x (= $\frac{N_1}{MC}$ *) and y (=* $\frac{N_2}{MC}$ *)*

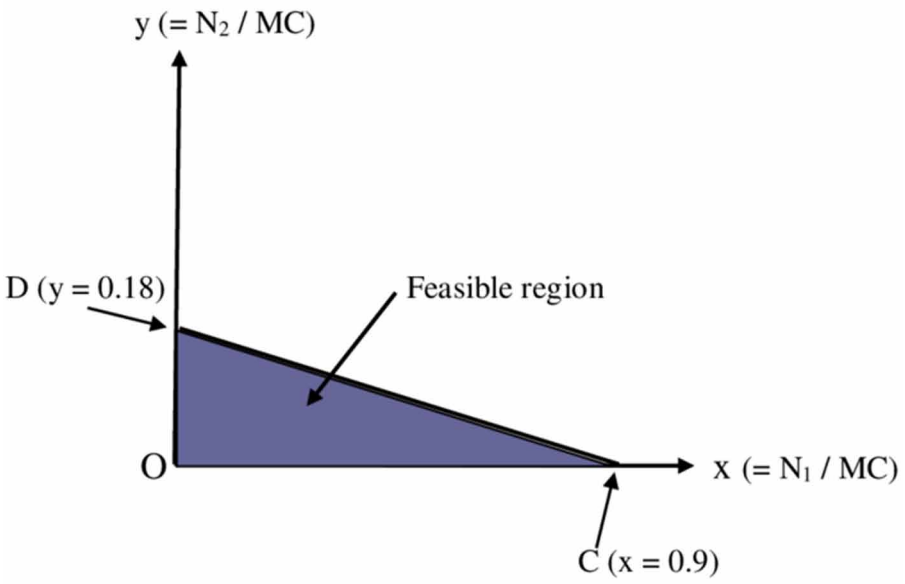
x	0.9	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
y	0	0.18	0.16	0.14	0.12	0.1	0.08	0.06	0.04	0.02

From Table 10, the *limiting values* of variables x and y may be plotted on a graph and all the intermediate values of x and y will fall within the *feasible* region as shown in Figure 7.

The area of the " $OAB = \frac{1}{2} \times OA \times OB = \frac{1}{2} \times 0.9 \times 0.18 = 0.081$ square unit.

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Figure 7. The feasible region for the solution sets of the ratios of the number of consumers in home and business sections to the marginal cost for Microsoft®



Now in order to analyze Microsoft's functional *domains* of (Gross) Profits (π) with respect to its Revenue (R) and Cost (C) respectively. First, the required regression result of (Gross) Profit (π) on Revenue (R) is taken into consideration as below (Refer to Table 11):

$$\pi(R) = 5654+0.63R \tag{25}$$

Table 11. The regression equation of (Gross) Profit (π) on Revenue (R) for Microsoft (1995 – 2020) [X Variable 1: Revenue (R)]

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.9910251
R Square	0.9821308
Adjusted R Square	0.9813863
Standard Error	3281.2691
Observations	26

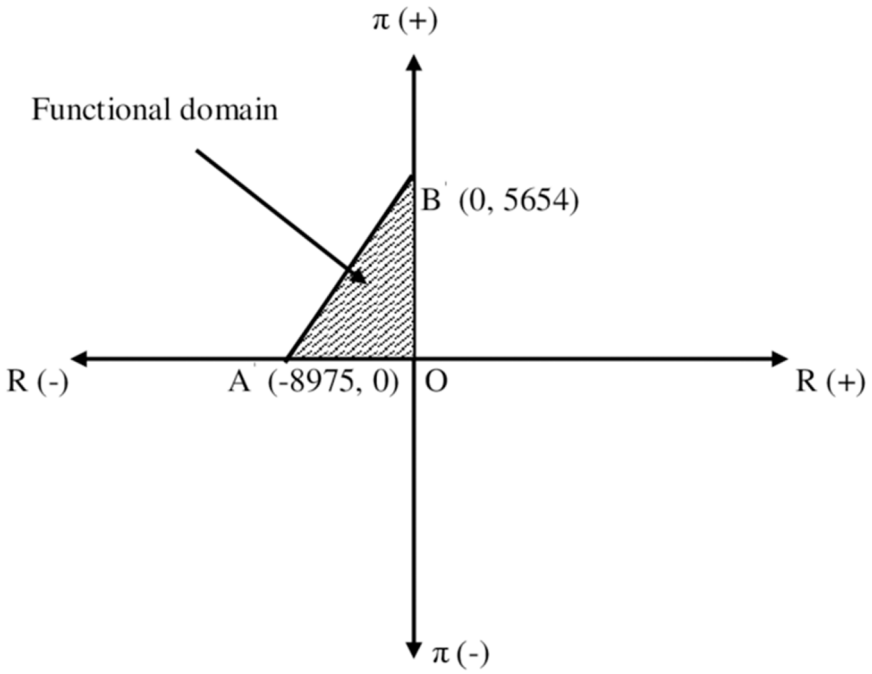
ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	14202335638	14202335638	1319.09	1.72257E-22
Residual	24	258401449.3	10766727.05		
Total	25	14460737087			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	5653.6665	1188.367752	4.757505862	7.7E-05	3200.996051	8106.337	3200.996051	8106.33704
X Variable 1	0.6323058	0.017409614	36.31934723	1.7E-22	0.596374146	0.6682375	0.596374146	0.6682375

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Figure 8. Microsoft's functional domain of (Gross) Profit (π) with respect to its Revenue (R)



Now, $\lim_{R\to 0+} \pi(R) = 5654 + 0 = 5654$ and $\lim_{R\to -8975} \pi(R) = 0$.

Microsoft's *functional domain* of (Gross) Profit (π) with respect to its Revenue (R) may be plotted as in Figure 8.

Table 12. The regression equation of (Gross) Profit (π) on Cost (C) for Microsoft (1995 – 2020) [X Variable 1: Cost (C)]

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.93518916
R Square	0.87457876
Adjusted R Square	0.86935287
Standard Error	8693.10932
Observations	26

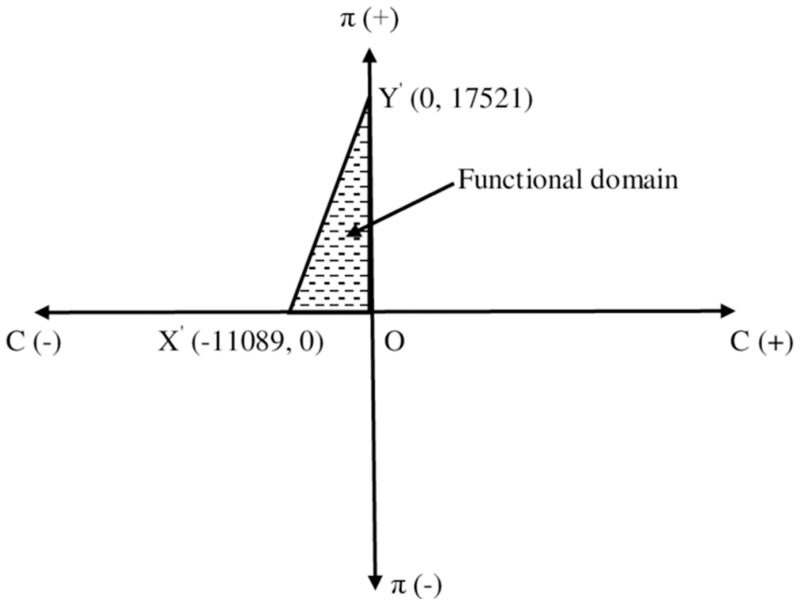
ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	12647053497	12647053497	167.355	2.59717E-12
Residual	24	1813683590	75570149.6		
Total	25	14460737087			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	17520.8756	2543.465579	6.888583713	4E-07	12271.42061	22770.331	12271.42061	22770.33051
X Variable 1	1.58079394	0.122195644	12.93658174	2.6E-12	1.328594526	1.8329934	1.328594526	1.832993356

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Figure 9. Microsoft's functional domain of (Gross) Profit (π) with respect to its Cost (C)



Similarly, the regression result of (Gross) Profit (π) on Cost (C) may be given as (Refer to Table 12):

$$\pi(C) = 17521 + 1.58C \tag{26}$$

So, $\lim_{C \to 0+} \pi(C) = 17521 + 0 = 17521$ and $\lim_{C \to -11089} \pi(C) = 0$.

Hence Microsoft's *functional domain* of (Gross) Profit (π) with respect to its Cost (C) may be plotted as in Figure 9.
Formally, to sum up:

$\pi(R) > 0$ when R>5654;
$\pi(R) = 0$ when R=5654; and
$\pi(R) < 0$ when R<5654.

Similarly,

$\pi(C) > 0$ when C> -11089;
$\pi(C) = 0$ when C= -11089.

Just like Netflix, Microsoft's (Gross) Profit is a *positive monotonic transformation* of its Revenue (R) function and *negative monotonic transformation* of its Cost (C) function respectively. As $C \to 0$, $\pi(C)$ increases in magnitude.

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For Netflix, the difference between the *limiting* values of Revenue (R) and (C) for π(R,*C)*=0 are both p*ositive,* i.e., R–*C* = *3*66174–342887 = 23,287 when $\pi(R,C)$=0.

On the contrary, for Microsoft; the difference between the l*imiting* values of Revenue (R) and (C) for π(R,*C)*=0 are pos*itive a*nd ne*gative r*espectively, i.e., R–*C* = *56*54–(–11089) = 16,743 when π(R,C*)=0*.

To put it simply, as compared to Netflix, Microsoft's profit domain is greater as its index of moligopoly power is greater in value.

Facebook®

The regression equation of Cost (C) on Revenue (R) for the time period of 11 years (2010 – 2020) may be illustrated as follows (Refer to Table 13):

$$C(N) = 0.18R(N) \tag{27}$$

Table 13. The regression equation of Cost (C) on Revenue (R) for Facebook (2010 – 2020) [X Variable 1: Revenue (R)]

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.9875527
R Square	0.9752604
Adjusted R Square	0.9725116
Standard Error	893.08585
Observations	11

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	282980819.8	282980820	354.789	1.53989E-08
Residual	9	7178421.077	797602.342		
Total	10	290159240.9			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-191.48505	394.6507698	-0.4852013	0.63913	-1084.24712	701.27701	-1084.24712	701.27701
X Variable 1	0.1812393	0.009622038	18.8358529	1.5E-08	0.159472726	0.2030058	0.159472726	0.2030058

By differentiating equation: (27) with respect to N, we have:

$$\frac{dC}{dN} = 0.18\frac{dR}{dN}$$

$\Rightarrow MC$=0.18MR

$\Rightarrow MR$=5.55MC

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$$\Rightarrow \frac{MR}{MC} = 5.55 \tag{28}$$

Thus, the Index of Moligopoly Power for Facebook (λ_{FCBK}) = 5.55

Now two interesting facts emerge when we try to regress the relationships between (Gross) profit (π) and revenue (R) and (Gross) profit (π) and revenue (C) respectively. (Refer to Table 14 and Table 15)

We have:

$$\pi(N) = 0.82R(N) \tag{29}$$

Table 14. The regression equation of (Gross) Profit (π) on Revenue (R) for Facebook (2010 – 2020) [X Variable 1: Revenue (R)]

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.9993791							
R Square	0.9987586							
Adjusted R Square	0.9986206							
Standard Error	893.08585							
Observations	11							
ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	1	5775190261	5775190261	7240.69	2.166E-14			
Residual	9	7178421.077	797602.342					
Total	10	5782368682						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	191.48505	394.6507698	0.48520126	0.63913	-701.27701	1084.2471	-701.277015	1084.24712
X Variable 1	0.8187607	0.009622038	85.0922364	2.2E-14	0.79699415	0.8405273	0.79699415	0.84052727

$$\pi(N) = 4.38C(N) \tag{30}$$

Equation: (29) may be rewritten as:

$\pi(N)=0.82[p(N)\times N]$ since $R(N)=p(N)\times N$

By differentiating equation: (29) with respect to N, the following result is obtained:

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Table 15. The regression equation of (Gross) Profit (π) on Cost (C) for Facebook (2010 – 2020) [X Variable 1: Cost (C)]

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.98139767
R Square	0.96314138
Adjusted R Square	0.95904598
Standard Error	4866.32556
Observations	11

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	5569238562	5569238562	235.176	9.30808E-08
Residual	9	213130120.2	23681124.5		
Total	10	5782368682			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1772.20118	2096.723492	0.84522408	0.41989	-2970.916886	6515.319	-2970.916886	6515.31924
X Variable 1	4.38106511	0.285682052	15.335458	9.3E-08	3.734807409	5.027323	3.734807409	5.02732281

$$\frac{d\pi}{dN} = 0.82\left[p + N\frac{dp}{dN}\right]$$
$$\Rightarrow \frac{d\pi}{dN} = 0.82p\left[1+\left(\frac{N}{p}\frac{dp}{dN}\right)\right] \quad (31)$$
$$\Rightarrow \frac{d\pi}{dN} = 0.82p\left(1-\frac{1}{e}\right)$$

[Since $e<0$] where

$e = \dfrac{\dfrac{dN}{N}}{\dfrac{dp}{p}}$ = Price elasticity of subscription (demand).

[The price elasticity of subscription (e) is assumed to be negative as an increase in the price of product for a particular segment would help to reduce the number of subscribers for that segment, *ceteris paribus*. It has been also assumed that the products offered by Facebook are *normal goods*]

Equation: (31) provides a plethora of information about the business model of Facebook. Since its primary products, e.g., Facebook account, WhatsApp, Instagram etc. are provided *free of cost*, hence p=0 for all its primary products - and that leads to the scenario of $\frac{d\pi}{dN} = 0$ for all its primary products.[6]

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In other words, Facebook is *not* concerned about the profit – level from its consumer base of primary products as a change (either increase or decrease) in its consumer base of primary products has absolutely *no* effect on its gross profit (π). As illustrated earlier, in case of the *free* products, Facebook enjoys *absolute monopolistic control* in the moligopolistic market (Refer to equation: 2a).

However, when $p>0$, i.e., in case of the commercial products (advertisements), Facebook's profit is *optimized* when $\frac{d\pi}{dN}=0$. Thus it follows:

$$\frac{d\pi}{dN}=0=0.82p\left(1-\frac{1}{e}\right)$$

$$\Rightarrow 0.82p\left(1-\frac{1}{e}\right)=0$$

$$\Rightarrow 1-\frac{1}{e}=0 \text{ (Since } p>0)$$

$$\Rightarrow |e|=1$$

Hence for *optimal profit* (π*), the price elasticity of subscription (e) for Facebook should be *unitary*. However, for Facebook; the *necessary and sufficient* condition for maintaining *positive monotonic transformation* of profit function would be:

$$\frac{d\pi}{dN}>0\Rightarrow e>1$$

In other words, the demand for subscription for "Facebook for Business" should be *elastic* in order to hold the condition for *positive monotonic transformation* of profit function.

In addition to that, Facebook's profit function is 5 times more sensitive in terms of its cost function as compared to its revenue function. The major reason behind this phenomenon is the existing pricing strategy of Facebook. While it has kept all its primary products / services free of cost, Facebook applies "Willingness to Pay (WTP)" principle in case of its commercial products / services (Facebook for Business). The concept of WTP is quite straightforward. According to Schmidt and Bijmolt (2020): "We take a standard economic view of WTP (or reservation price) and define it as the maximum price a consumer is willing to pay for a given quantity of a product or a service (Wertenbroch and Skiera 2002). At that price, the consumer is indifferent to buying or not buying, because WTP reflects the product's inherent value in monetary terms. That is, the product and the money have the same value, so spending to obtain a product is the same as keeping the money".

The consumer's Reservation Price may be defined as 'the price at which a consumer is indifferent between buying and not buying the product' (Jedidi and Zhang; 2002, p. 1352).
Following Jedidi and Jagpal (2009), it may be expressed as:

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$$U(g,y - R(g)) - U(0,y) \equiv 0 \tag{32}$$

where g= Product,
y= Income of the consumer,
$U(g,y–p)$= Utility of the consumer for buying the product at price p,
$U(0,y)$= Utility of the consumer for *not* buying the product at price p,
$R(g)$= Reservation price of product g.
The WTP principle may be broadly divided into 2 parts:

a) Hypothetical measure of WTP (HWTP), and
b) Realistic measure of WTP (RWTP).

For Facebook, there are no *fixed* upper or lower bounds of prices for its products, i.e., advertisements. The firm uses "bidding" or "auction" strategy for its business consumers. Facebook offers 3 types of bidding offers to its consumers, they are: spend (expenditure) – based, goal – based, and manual bidding respectively. This WTP method is known as Choice - based Conjoint (CBC) method and treated as a part of RWTP (Jedidi and Jagpal, 2009).

Since Facebook enjoys monopolistic power in the market with *no* clear competitor in sight, it uses CBC method to implement *product line pricing* decision (Jedidi and Jagpal, 2009) for its consumers. Under this strategy, it *optimally* mixes prices with offers in order to extract consumers' surplus accordingly.

Google®

The regression equation of Cost (C) on Revenue (R) for the time period of 8 years (2013 – 2020) is as follows (Refer to Table 16):

$$C(N) = -8058 + 0.5R(N) \tag{33}$$

By differentiating equation: (33) with respect to N, the following result is derived:

$$\frac{dC}{dN} = 0.5\frac{dR}{dN}$$

$$\Rightarrow MC = 0.5MR$$

$$\Rightarrow MR = 2MC$$

$$\Rightarrow \frac{MR}{MC} = 2 \tag{34}$$

Hence the Index of Moligopoly Power for Google (λ_{GOOGL}) = 2
The regression equations of (Gross) profit (π) on revenue (R) and cost (C) respectively for Google are detailed as below (Refer to Table 17 and Table 18):

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Table 16. The regression equation of Cost (C) on Revenue (R) for Google (2013 – 2020) [X Variable 1: Revenue (R)]

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.9976667							
R Square	0.9953388							
Adjusted R Square	0.9945619							
Standard Error	1712.8672							
Observations	8							
ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	1	3758998352	3758998352	1281.22	3.17032E-08			
Residual	6	17603483.73	2933913.95					
Total	7	3776601836						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-8058.287	1642.541234	-4.9059874	0.00269	-12077.4403	-4039.1331	-12077.44	-4039.1331
X Variable 1	0.4974885	0.013898587	35.794177	3.2E-08	0.463479879	0.5314971	0.46347988	0.53149712

Table 17. The regression equation of (Gross) Profit (π) on Revenue (R) for Google (2013 – 2020) [X Variable 1: Revenue (R)]

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.99771293							
R Square	0.9954311							
Adjusted R Square	0.99466962							
Standard Error	1712.86717							
Observations	8							
ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	1	3835288722	3835288722	1307.23	2.98559E-08			
Residual	6	17603483.73	2933913.95					
Total	7	3852892206						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	8058.28667	1642.541234	4.90598744	0.00269	4039.133054	12077.44	4039.133054	12077.44028
X Variable 1	0.5025115	0.013898587	36.155581	3E-08	0.468502885	0.53652	0.468502885	0.536520121

$$\pi(N) = 8058+0.5R(N) \tag{35}$$

$$\pi(N) = 16634+C(N) \tag{36}$$

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Table 18. The regression equation of (Gross) Profit (π) on Cost (C) for Google (2013 – 2020) [X Variable 1: Cost (C)]

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.9907701
R Square	0.9816255
Adjusted R Square	0.978563
Standard Error	3434.995
Observations	8

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	3782097062	3782097062	320.539	1.95216E-06
Residual	6	70795144.34	11799190.7		
Total	7	3852892206			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	16634.489	2873.588649	5.78875096	0.00116	9603.070943	23665.907	9603.070943	23665.90719
X Variable 1	1.0007273	0.055895328	17.9035942	2E-06	0.86395633	1.1374982	0.86395633	1.137498212

Hence $\lim_{R\to 0+}\pi(R)=8058+0=8058$ and $\lim_{R\to -16116}\pi(R)=0$.

Similarly, $\lim_{C\to 0+}\pi(C)=16634+0=16634$ and $\lim_{C\to -16634}\pi(C)=0$

Therefore, with reference to equation: (34), Google's functional domain of (Gross) Profit (π) with respect to its Revenue (R) may be plotted in Figure 10.

Similarly, with reference to equation: (35), Google's functional domain of (Gross) Profit (π) with respect to its Cost (C) may be plotted as in Figure 11.

Since Google follows an *identical* business model as Facebook, hence like Facebook, the *necessary and sufficient* condition for maintaining *positive monotonic transformation* of profit function would be:

$$\frac{d\pi}{dN}>0\Rightarrow e>1$$

where

$$e=\frac{\frac{dN}{N}}{\frac{dp}{p}}=\text{Price elasticity of subscription (demand).}$$

Finally, there is a need to verify whether the three big firms adhere to the *equilibrium condition*

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Figure 10. Google's functional domain of (Gross) Profit (π) with respect to its Revenue (R)

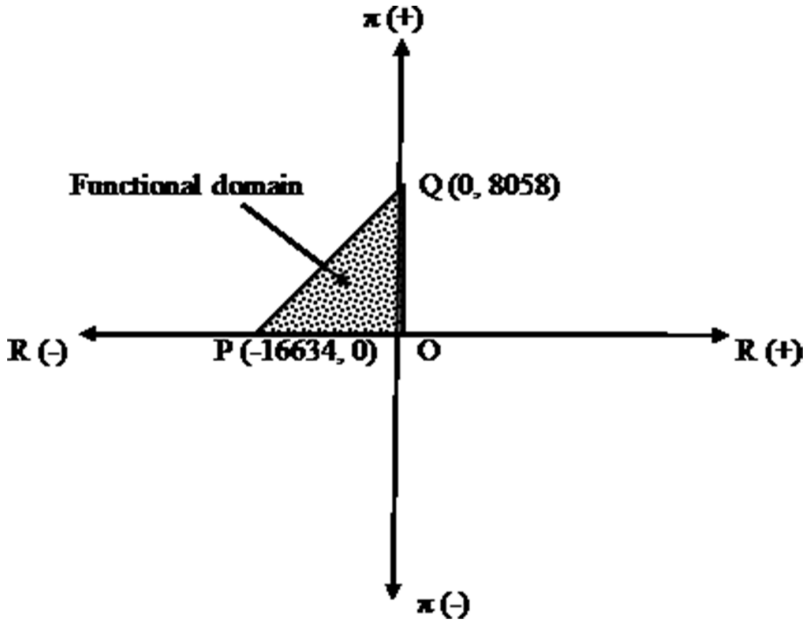
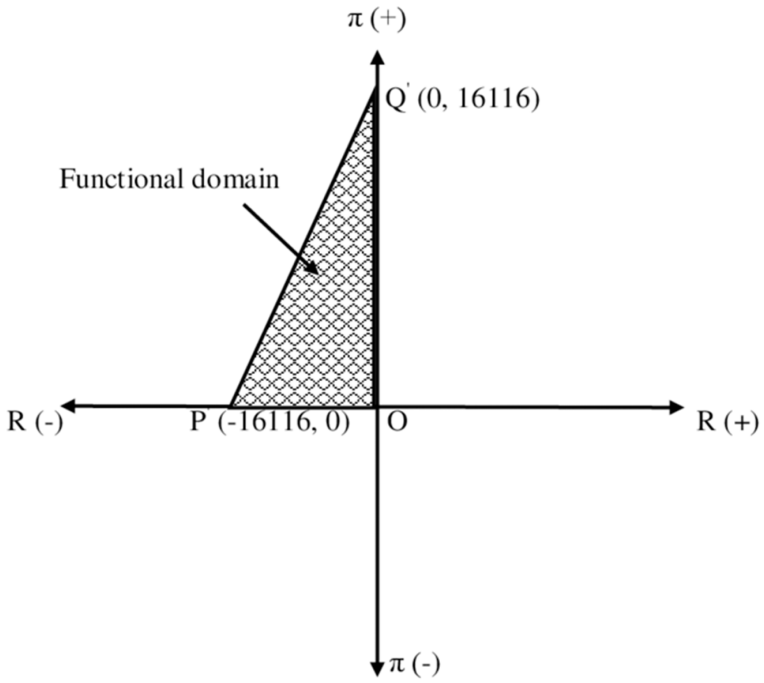


Figure 11. Google's functional domain of (Gross) Profit (π) with respect to its Cost (C)



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$$\alpha^* = \beta^* = \left(\frac{1}{T-1}\right)e^{\frac{1}{T}}$$

where $\alpha^{*=}$ Optimal sales coefficient and $\beta^{*}=$ Optimal cost coefficient (Refer to equation: 15). The ex-*pected optimal values o*f α and β for the 4 firms are given in Table 19.

Table 19. Estimation of optimal values of sales and cost coefficients for Netflix®, Microsoft®, Facebook®, and Google® respectively

Name of the firm	Time period (T)	Optimal Sales Coefficient (α^{*})	Optimal Cost Coefficient (β^{*})
Netflix®	19 years	0.06	0.06
Microsoft®	25 years	0.04	0.04
Facebook®	10 years	0.12	0.12
Google®	7 years	0.19	0.19

Note: The ***Base Year*** is **2001** for Netflix, i.e., the Base Year (2001) values of Revenue and Cost are R_0 and C_0 respectively. The formulae used for estimating the values of revenue and cost functions for the time period of 19 years (2002 – 2020) are: $R_t = R_0 e^{\alpha t}$ and $Ct_{=} C0_e \beta^{t\,r}$espectively (t = 1, 2, …., 19).

Hence $\alpha = \dfrac{\ln\left(\dfrac{R_t}{R_0}\right)}{t} = \dfrac{R1}{t}$ and $\beta = \dfrac{\ln\left(\dfrac{C_t}{C_0}\right)}{t} = \dfrac{C1}{t}$ (Refer to Tables 20-21).

Note: The ***Base Year*** is **1995** for Microsoft, i.e., the Base Year (1995) values of Revenue and Cost are R_0 and C_0 respectively. The formulae used for estimating the values of revenue and cost functions for the time period of 25 years (1996 – 2020) are: $R_t = R_0 e^{\alpha t}$ and $Ct_{=} C0_e \beta^{t\,r}$espectively (t = 1, 2, …., 25).

Hence $\alpha = \dfrac{\ln\left(\dfrac{R_t}{R_0}\right)}{t} = \dfrac{R1}{t}$ and $\beta = \dfrac{\ln\left(\dfrac{C_t}{C_0}\right)}{t} = \dfrac{C1}{t}$ (Refer to Tables 22-23).

Note: The ***Base Year*** is **2010** for Facebook, i.e., the Base Year (2010) values of Revenue and Cost are R_0 and C_0 respectively. The formulae used for estimating the values of revenue and cost functions for the time period of 10 years (2011 – 2020) are: $R_t = R_0 e^{\alpha t}$ and $Ct_{=} C0_e \beta^{t\,r}$espectively (t = 1, 2, …..., 10).

Hence $\alpha = \dfrac{\ln\left(\dfrac{R_t}{R_0}\right)}{t} = \dfrac{R1}{t}$ and $\beta = \dfrac{\ln\left(\dfrac{C_t}{C_0}\right)}{t} = \dfrac{C1}{t}$ (Refer to Tables 24-25).

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Table 20. Estimation of revenue coefficients (α) for Netflix (2002 – 2020) [Base Year: 2001]

Year	t	R	R0	R1	α
2002	1	1,52,806	75,912	0.6996	0.6996
2003	2	2,70,410	75,912	1.2704	0.6352
2004	3	5,00,611	75,912	1.8863	0.6288
2005	4	6,82,213	75,912	2.1958	0.5489
2006	5	9,96,660	75,912	2.5748	0.515
2007	6	12,05,340	75,912	2.7649	0.4608
2008	7	13,64,661	75,912	2.8891	0.4127
2009	8	16,70,269	75,912	3.0912	0.3864
2010	9	21,62,625	75,912	3.3495	0.3722
2011	10	32,04,577	75,912	3.7428	0.3743
2012	11	36,09,282	75,912	3.8617	0.3511
2013	12	43,74,562	75,912	4.054	0.3378
2014	13	55,04,656	75,912	4.2838	0.3295
2015	14	67,79,511	75,912	4.4921	0.3209
2016	15	88,30,669	75,912	4.7564	0.3171
2017	16	1,16,92,713	75,912	5.0371	0.3148
2018	17	1,57,94,341	75,912	5.3378	0.314
2019	18	2,01,56,447	75,912	5.5817	0.3101
2020	19	2,49,96,056	75,912	5.7969	0.3051

Table 21. Estimation of Cost coefficients (β) for Netflix (2002 – 2020) [Base Year: 2001]

Year	t	C	C0	C1	β
2002	1	78,136	49,907	0.44829	0.44829
2003	2	1,79,010	49,907	1.27728	0.63864
2004	3	3,31,712	49,907	1.89411	0.63137
2005	4	4,65,775	49,907	2.23354	0.55839
2006	5	6,26,985	49,907	2.53076	0.50615
2007	6	7,86,168	49,907	2.75701	0.4595
2008	7	9,10,234	49,907	2.90354	0.41479
2009	8	10,79,271	49,907	3.07388	0.38423
2010	9	13,57,355	49,907	3.30313	0.36701
2011	10	20,39,901	49,907	3.7105	0.37105
2012	11	26,25,866	49,907	3.963	0.36027
2013	12	30,83,256	49,907	4.12358	0.34363
2014	13	37,52,760	49,907	4.32009	0.33231
2015	14	45,91,476	49,907	4.5218	0.32299
2016	15	60,29,901	49,907	4.79432	0.31962
2017	16	76,59,666	49,907	5.03356	0.3146
2018	17	99,67,538	49,907	5.29693	0.31158
2019	18	1,24,40,213	49,907	5.51853	0.30658
2020	19	1,52,76,319	49,907	5.7239	0.30126

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Table 22. Estimation of Revenue coefficients (α) for Microsoft (1996 – 2020) [Base Year: 1995]

Year	t	R	R0	R1	α
1996	1	8,671	5,937	0.37878	0.37878
1997	2	11,358	5,937	0.64872	0.32436
1998	3	15,262	5,937	0.94416	0.31472
1999	4	19,747	5,937	1.2018	0.30045
2000	5	22,956	5,937	1.35238	0.27048
2001	6	25,296	5,937	1.44944	0.24157
2002	7	28,365	5,937	1.56395	0.22342
2003	8	32,187	5,937	1.69036	0.21129
2004	9	36,835	5,937	1.82524	0.2028
2005	10	39,788	5,937	1.90236	0.19024
2006	11	44,282	5,937	2.00937	0.18267
2007	12	51,122	5,937	2.15301	0.17942
2008	13	60,420	5,937	2.32012	0.17847
2009	14	58,437	5,937	2.28675	0.16334
2010	15	62,484	5,937	2.35371	0.15691
2011	16	69,943	5,937	2.46648	0.15415
2012	17	73,723	5,937	2.51911	0.14818
2013	18	77,849	5,937	2.57357	0.14298
2014	19	86,833	5,937	2.68278	0.1412
2015	20	93,580	5,937	2.75761	0.13788
2016	21	91,154	5,937	2.73135	0.13006
2017	22	96,571	5,937	2.78907	0.12678
2018	23	1,10,360	5,937	2.92254	0.12707
2019	24	1,25,843	5,937	3.05383	0.12724
2020	25	1,43,015	5,937	3.18175	0.12727

Note: The ***Base Year*** is **2013** for Google, i.e., the Base Year (2013) values of Revenue and Cost are R_0 and C_0 respectively. The formulae used for estimating the values of revenue and cost functions for the time period of 7 years (2014 – 2020) are: $R_t = R_0 e^{\alpha t}$ and $C t = C0 e \beta^{t}$ respectively (t = 1, 2, ….., 7).

Hence $\alpha = \dfrac{\ln\left(\dfrac{R_t}{R_0}\right)}{t} = \dfrac{R1}{t}$ and $\beta = \dfrac{\ln\left(\dfrac{C_t}{C_0}\right)}{t} = \dfrac{C1}{t}$ (Refer to Tables 26-27).

A close observation of the estimated values of α and β for the first 3 firms prove the fact that *not* for a *single* year the *optimal values* of α and β are achieved for the given time series of 19, 25, 10, and 7 years respectively. For the fourth sample firm Google, the cost coefficient β reached the *optimal* level in the year 2020.

The findings about the "Big Tech" moligopolistic firms may be summarized as below:

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Table 23. Estimation of cost coefficients (β) for Microsoft (1996 – 2020) [Base Year: 1995]

Year	t	C	C0	C1	β
1996	1	1,188	877	0.30352	0.30352
1997	2	1,085	877	0.21283	0.10641
1998	3	2,460	877	1.03141	0.3438
1999	4	2,814	877	1.16586	0.29146
2000	5	3,002	877	1.23053	0.24611
2001	6	3,455	877	1.37107	0.22851
2002	7	5,699	877	1.87154	0.26736
2003	8	6,059	877	1.93279	0.2416
2004	9	6,596	877	2.01771	0.22419
2005	10	6,031	877	1.92816	0.19282
2006	11	7,650	877	2.16595	0.1969
2007	12	10,693	877	2.50084	0.2084
2008	13	11,598	877	2.58208	0.19862
2009	14	12,155	877	2.62899	0.18778
2010	15	12,395	877	2.64854	0.17657
2011	16	15,577	877	2.87704	0.17982
2012	17	17,530	877	2.99516	0.17619
2013	18	20,249	877	3.13935	0.17441
2014	19	27,078	877	3.42997	0.18052
2015	20	33,038	877	3.62891	0.18145
2016	21	32,780	877	3.62107	0.17243
2017	22	34,261	877	3.66526	0.1666
2018	23	38,353	877	3.77808	0.16426
2019	24	42,910	877	3.89035	0.1621
2020	25	46,078	877	3.96158	0.15846

Table 24. Estimation of Revenue coefficients (α) for Facebook (2011 – 2020) [Base Year: 2010]

Year	t	R	R0	R1	α
2011	1	3,711	1,974	0.63124	0.63124
2012	2	5,089	1,974	0.94702	0.47351
2013	3	7,872	1,974	1.38325	0.46108
2014	4	12,466	1,974	1.84294	0.46074
2015	5	17,928	1,974	2.2063	0.44126
2016	6	27,638	1,974	2.63913	0.43985
2017	7	40,653	1,974	3.02501	0.43214
2018	8	55,838	1,974	3.34239	0.4178
2019	9	70,697	1,974	3.57834	0.39759
2020	10	85,965	1,974	3.77388	0.37739

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Table 25. Estimation of Cost coefficients (β) for Facebook (2011 – 2020) [Base Year: 2010]

Year	t	C	C0	C1	β
2011	1	860	493	0.55642	0.55642
2012	2	1,364	493	1.01767	0.50883
2013	3	1,875	493	1.33585	0.44528
2014	4	2,153	493	1.47411	0.36853
2015	5	2,867	493	1.76051	0.3521
2016	6	3,789	493	2.03935	0.33989
2017	7	5,454	493	2.4036	0.34337
2018	8	9,355	493	2.94316	0.36789
2019	9	12,770	493	3.25434	0.36159
2020	10	16,692	493	3.52218	0.35222

Table 26. Estimation of Revenue coefficients (α) for Google (2014 – 2020) [Base Year: 2013]

Year	t	R	R0	R1	α
2014	1	66001	55519	0.17294	0.17294
2015	2	74989	55519	0.30062	0.15031
2016	3	90272	55519	0.4861	0.16203
2017	4	110855	55519	0.6915	0.17287
2018	5	136819	55519	0.90193	0.18039
2019	6	161857	55519	1.06999	0.17833
2020	7	182527	55519	1.19017	0.17002

Table 27. Estimation of Cost coefficients (β) for Google (2014 – 2020) [Base Year: 2013]

Year	t	C	C0	C1	β
2014	1	25691	21993	0.15542	0.15542
2015	2	28164	21993	0.24732	0.12366
2016	3	35138	21993	0.46856	0.15619
2017	4	45583	21993	0.72881	0.1822
2018	5	59549	21993	0.99608	0.19922
2019	6	71896	21993	1.1845	0.19742
2020	7	84732	21993	1.34877	0.19268

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1. There is *no* specific or unique business model which is followed by the moligopolist behemoths apart from the fact that these giant firms implement different pricing strategy to gain the lion's share of the market;
2. The firms may or may *not* sell homogeneous products. In case two or firms sell homogeneous products, the competitors use their pricing strategy as a tool for extraction of larger volume of consumers' surplus;
3. The greater the degree of *heterogeneity* of products and innovation, the higher is the magnitude of the index of moligopoly power; and
4. Since there is absence of *equilibrium* condition in the moligopolistic market, the firms always concentrate on reducing the cost of sales / cost and spend more on advertising and marketing promotion to promote their products in the era of digital economy.

Introduction of Profit as an Uncertainty Variable in the Moligopoly Model

In order to explain the non-uniform movements of the (gross) profit functions of the moligopolistic firms, a *generalized* form of *linear uncertain variable* is introduced in the system. According to Liu (2010; p. 16): "An uncertain variable ξ is called linear if it has a linear uncertainty distribution

$$\phi(x)=\begin{cases}0, & \text{if } x\le a\\ \dfrac{x-a}{b-a}, & \text{if } a\le x\le b\\ 1, & \text{if } x\ge b\end{cases}$$

denoted by $\mathcal{L}(a,b)$ where a and b are real numbers with $a<b$."
Hence the *Cumulative Distribution Function (CDF)* of ϕ(x) may be expressed as below (Das, 2008):

$$F(x)=\int_{-\infty}^{+\infty}\phi(x)\,dx=\int_{-\infty}^{a}\phi(x)\,dx+\int_{a}^{b}\phi(x)\,dx+\int_{b}^{\infty}\phi(x)\,dx=0+\int_{a}^{b}\frac{x-a}{b-a}\,dx+1=1+\left[\frac{(x-a)^2}{2(b-a)}\right]_{a}^{b}=\frac{(b-a)+2}{2}$$

In a similar fashion, the CDF of the profit (π) function of the moligopolistic firms may be expressed as:

$$F(\pi)=\int_{-\infty}^{+\infty}\phi(\pi)\,d\pi=\frac{(b-a)+2}{2}$$

Now the question arises whether the variable profit (π) is a *discrete random variable* or a *continuous random variable*. To quote Das (2008): "If X is a continuous random variable, the number of possible values which it can assume is uncountably infinite, and hence the probability function cannot be defined

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in the same manner as for a discrete random variable. In this case we introduce a function $f(x)$ such that it satisfies two conditions: (i) $f(x)\geq 0$; (ii) $\int_{-\infty}^{+\infty} f(x)\,dx = 1$".

Since $b>a$, hence $\int_{-\infty}^{+\infty} \phi(\pi)\,d\pi = \frac{(b-a)+2}{2} > 1$; and thus profit ($\pi$) for the moligopolist firms does *not* fall within the ambit of continuous random variable.

Under this situation, the concept of discrete random variable should be taken into account. According to Das (2008): "Let X be a discrete random variable which can assume the values $x_1, x_2, x_3,\ldots$ (arranged in an increasing order of magnitude) with probabilities $p_1, p_2, p_3,\ldots$ respectively ($\sum_i p_i = 1$). The specification of the set of values x_i together with their probabilities p_i (i=1,2,3,…) defines the *discrete probability distribution* of X.

Let us write $f(x)$ to denote the probability that X takes a specified value x.

$$f(x) = P(X=x)$$

The function $f(x)$ is called the *probability mass function* (PMF) or simply the *probability function* of the discrete random variable X. It satisfies two conditions: (i) $f(x)\geq 0$, (ii) $\sum f(x)=1$".

Also, for the discrete random variable X which can assume the values $x_1, x_2, x_3,\ldots$ (arranged in an increasing order of magnitude) with probabilities $p_1, p_2, p_3,\ldots$ respectively ($\sum_i p_i = 1$); the *expected* value of x is expressed as:

$$E(x) = \sum p_i x_i$$

The *expected* value of x^2 is similarly defined as:

$$E\left(x^2\right) = \sum p_i x_i^2$$

The *mean* of a probability distribution is the expected value of x:

$$\text{Mean } (\mu) = \text{E(x)} = \sum \text{p}i_x i$$

The *variance* is the expected value of $(x-\mu)2$· where μ is the mean.

$$\text{Variance } (\sigma 2) = \text{E}(x-\mu)2 = \text{E(x}2) \text{ - } [E(\text{x})2]$$

Thus

$$\sigma 2 = \sum p_i x_i^2 - \left[\left(\sum p_i x_i\right)^2\right];$$

and Standard Deviation

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$$(\sigma) = \sqrt{\sum p_i x_i^2 - \left[\left(\sum p_i x_i\right)^2\right]}$$

(Das, 2008)

According to the *classical* definition of probability: "If a random experiment has n possible outcomes, which are *mutually exclusive*, *exhaustive* and *equally likely*, and *m* of these are favourable to an event *A*, then the 'probability' of the event is defined as the ratio $\frac{m}{n}$. In symbols: $p(A) = \frac{m}{n}$

Probability of an event =

$$\frac{\textit{Number of outcomes favourable to the event}}{\textit{Total number of mutually exclusive, exhaustive and equally likely outcomes of the random experiment}}$$

(Das, 2008)"

Table 28. Estimation of mean, standard deviation, and coefficient of variation for Netflix (2001 – 2020)

Year	Gross Profit (π)	p * π	p * π * π
2001	26,005	1300.25	3.4E+07
2002	74,670	3733.5	2.8E+08
2003	91,400	4570	4.2E+08
2004	1,68,899	8444.95	1.4E+09
2005	2,16,438	10821.9	2.3E+09
2006	3,69,675	18483.8	6.8E+09
2007	4,19,172	20958.6	8.8E+09
2008	4,54,427	22721.4	1E+10
2009	5,90,998	29549.9	1.7E+10
2010	8,05,270	40263.5	3.2E+10
2011	11,64,676	58233.8	6.8E+10
2012	9,83,416	49170.8	4.8E+10
2013	12,91,306	64565.3	8.3E+10
2014	17,51,896	87594.8	1.5E+11
2015	21,88,035	109402	2.4E+11
2016	28,00,768	140038	3.9E+11
2017	40,33,047	201652	8.1E+11
2018	58,26,803	291340	1.7E+12
2019	77,16,234	385812	3E+12
2020	97,19,737	485987	4.7E+12
		2034644	**1.1E+13**
		SD	2671458
		Mean	2034644
		CV	131.299

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Table 29. Estimation of Mean, Standard Deviation, and Coefficient of variation for Microsoft (1995 – 2020)

Year	Gross Profit (π)	p * π	p * π * π
1995	5,060	192.28	972936.8
1996	7,483	284.354	2127820.98
1997	10,273	390.374	4010312.1
1998	12,802	486.476	6227865.75
1999	16,933	643.454	10895606.6
2000	19,954	758.252	15130160.4
2001	21,841	829.958	18127112.7
2002	22,666	861.308	19522407.1
2003	26,128	992.864	25941550.6
2004	30,239	1149.08	34747090.6
2005	33,757	1282.77	43302331.9
2006	36,632	1392.02	50992330.1
2007	40,429	1536.3	62111153.6
2008	48,822	1855.24	90576332
2009	46,282	1758.72	81396893.9
2010	50,089	1903.38	95338501
2011	54,366	2065.91	112315154
2012	56,193	2135.33	119990823
2013	57,600	2188.8	126074880
2014	59,755	2270.69	135685081
2015	60,542	2300.6	139282683
2016	58,374	2218.21	129485907
2017	62,310	2367.78	147536372
2018	72,007	2736.27	197030306
2019	82,933	3151.45	261359535
2020	96,937	3683.61	357077715
		41435.5	**2287258862**
		SD	23882.2323
		Mean	41435.5
		CV	57.6371283

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Table 30. Estimation of mean, standard deviation, and coefficient of variation for Facebook (2010 – 2020)

Year	Gross Profit (π)	p * π	p * π * π
2010	1,481	133.29	197402.49
2011	2,851	256.59	731538.09
2012	3,725	335.25	1248806.25
2013	5,997	539.73	3236760.81
2014	10,313	928.17	9572217.21
2015	15,061	1355.49	20415034.9
2016	23,849	2146.41	51189732.1
2017	35,199	3167.91	111507264
2018	46,483	4183.47	194460236
2019	57,927	5213.43	301998360
2020	69,273	6234.57	431887368
		24494.3	**1126444719**
		SD	22945.0103
		Mean	24494.3
		CV	93.6748969

Table 31. Estimation of mean, standard deviation, and coefficient of variation for Google (2013 – 2020)

Year	Gross Profit (π)	p * π	p * π * π
2013	33526	4190.75	140499085
2014	40310	5038.75	203112013
2015	46825	5853.13	274072578
2016	55134	6891.75	379969745
2017	65272	8159	532554248
2018	77270	9658.75	746331613
2019	89961	11245.1	1011622690
2020	97795	12224.4	1195482753
		63261.6	**4483644723**
		SD	21945.6494
		Mean	63261.6
		CV	34.6903166

Formally, $p_i = \frac{1}{T}$ for all the 4 sample firms where T = Number of years in the time series. Hence the probability distributions for 4 firms are as follows:

- Netflix: $p_i = \frac{1}{T} = \frac{1}{20} = 0.05$;
- Microsoft: $p_i = \frac{1}{T} = \frac{1}{26} = 0.038$;

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- Facebook: $p_i = \frac{1}{T} = \frac{1}{11} = 0.09$; and
- Google: $p_i = \frac{1}{T} = \frac{1}{8} = 0.125$

By following the definitions of mean and variance of a random discrete variable X, *Means*, *Standard Deviations (SD)*, and *Coefficients of Variation (CV)* of the discrete random variable π (Gross profit) for the 4 sample firms are estimated (Refer to Tables 28-31).

Working

We have $E(\pi) = \sum p i_{\pi} i$, $E\left(\pi^2\right) = \sum p_i \pi_i^2$,

Standard Deviation $\left(\sigma\right) = \sqrt{\sum p_i \pi_i^2 - \left[\left(\sum p_i \pi_i\right)^2\right]}$, and

Coefficient of variation (CV) = (Standard Deviation ÷ Mean) × 100

The summarized results from Tables: 28 – 31 are illustrated in Table 32.

Table 32. Documentation of the means, standard deviations, and oefficients of variation for Netflix, Microsoft, Facebook, and Google respectively.

Name of the firm	Mean	Standard Deviation	Coefficient of variation (%)	Reference
Netflix®	2034644	2671458	131	Table 28
Microsoft®	41435.5	23882	58	Table 29
Facebook®	24494	22945	94	Table 30
Google®	63262	21946	35	Table 31

A close observation of Table 32 gives us a clear idea that out of the 4 “Big Tech” firms, Google is the *most* consistent company in economic performance (with the *lowest* CV) and Netflix is the *least* consistent company in economic performance (with the *highest* CV). However, if the duration of time series is taken into consideration, Microsoft might be the most consistent company in terms of economic performance as the time period of study for Microsoft is 26 years compared to Google’s time period of study of 8 years.

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OBJECTIVE

In the modern era of digitization, emergence of large 'Tech' firms has radically changed the fundamental basis of traditional microeconomic 'Theory of firm'. The traditional theory of firm rested on the basis of *physical* production (manufacturing) of commodities. However, with the advent of Industrial Revolution 4.0, i.e.; the digital revolution – the economic concept of "profit maximization" has become completely outdated as the cost of production has followed a continual downward trend accompanied by ever increasing revenue for the digital firms. The *equilibrium condition* of the firm which was formulated by solely keeping in mind the perspective of manufacturing firms is no longer applicable for the firms in the current digital industry. Hence under these changed circumstances, there was an urgent requirement of *rewriting* the existing norms related to the theory of firm and theory of production.

Petit's (2020) coining of the term 'moligopoly' and significant research associated with it primarily helped the audience to understand its underlying concept and the functioning of the digital firms, however; his research suffered from the quintessential problem of *not* projecting the fundamental structure and hypotheses of moligopoly in terms of a distinguished economic model. This research work is intended to fill in the gaps left in the *generic* moligopoly model. It has not only attempted to *formalize* the proposed model in terms of quantitative modelling but also tested its fundamental hypotheses in the real-word scenario based on an inter-organizational study. Hence it may be emphatically stated that this research would help to throw light on a fairly new topic which is not only relevant but also extremely important in the changing course of economic theories in the times of digital revolution.

Limitations

1. The research work is based on 4 major "Big Tech" firms only, so more elaborate research consisting of other E-Commerce business organizations would help to provide a broader perspective in the domain of moligopoly market; and
2. In case of firm like Facebook, the financial statements are few in number (11 years) on its official website despite the fact that it had started its business operations much earlier in the year 2004. Due to non-availability of the financial statements of Facebook during the time period (2004 – 2009), there remains a lacuna in studying the business model of Facebook albeit involuntary in nature.

CONCLUSION

This research paper may be treated as a travelogue for the newly evolving (and simultaneously flourishing) land of moligopoly located in the vast continent of digital and sharing economy. As a curious as well as serious explorer of this newly evolving region, an earnest effort has been made to delve into the intricacies of this ever-changing, dynamic organism of digitization. It is hoped that this research work would not only focus on the structural modelling of the moligopoly model but also open up new vistas of advanced research in the said domain for the future researchers.

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Data Availability Statement

Data available at: https://ir.netflix.net/investor-news-and-events/financial-releases/default.aspx

Data available at: https://www.microsoft.com/en-us/Investor/annual-reports.aspx

Data available at: https://investor.fb.com/financials/default.aspx

Data available at: https://abc.xyz/investor/#numbers

Data available at: www.statista.com

Information available at: https://help.netflix.com/en/node/24926/us

Information available at: https://www.amazon.com/gp/help/customer/display.html?nodeId=G34EUPKVMYFW8N2U

Information available at: https://www.microsoft.com/en-us/microsoft-365/buy/compare-all-microsoft-365-products

Information available at: https://en-gb.facebook.com/business/help/201828586525529?id=629338044106215&recommended_by=716180208457684

For Netflix®, values are in US$ (in '000)

For Microsoft®, Facebook®, and Google®; values are in US$ (in million)

Conflicts of Interests Statement

The author has NO interests with / or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

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ENDNOTES

1 Data available at: https://www.microsoft.com/en-us/Investor/annual-reports.aspx

2 See Google, Inc, Form 10- K, US SEC, 2009

3 Information available at: https://help.netflix.com/en/node/24926/us

4 Information available at: https://www.amazon.com/gp/help/customer/display.html?nodeId=G34EUPKVMYFW8N2U

5 Information available at: https://www.microsoft.com/en-us/microsoft-365/buy/compare-all-microsoft-365-products

6 Information available at: https://en-gb.facebook.com/business/help/201828586525529?id=629338044106215&recommended_by=716180208457684

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APPENDIX: TERMS

R (N): Revenue/Sales of the firm as a function of the number of subscribers (N);
C (N): Cost/Cost of Sales of the firm as a function of the number of subscribers (N);
π (N): (Gross) Profit of the firm as a function of the number of subscribers (N);
MR: Marginal revenue of the firm;
MC: Marginal cost of the firm;
λ_{NFLX}: Index of moligopoly power for Netflix;
λ_{AMZN}: Index of moligopoly power for Amazon Prime Video;
λ_{MSFT}: Index of moligopoly power for Microsoft;
λ_{FCBK}: Index of moligopoly power for Facebook;
λ_{GOOGL}: Index of moligopoly power for Google;
e: Price elasticity of subscription (demand);
α: Revenue/Sales coefficient; and
β: Cost coefficient.

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Chapter 18
Co-Creating Digital Transformation

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ABSTRACT

The purpose of this chapter is to discuss two subfields of marketing, namely digital transformation and co-creation, that share common characteristics and possess key differences. The initial focus is on the digital transformation subfield, in terms of the definition, phases, strategies, business models and resource integration, and finally, the new technologies and platforms. Subsequently, the chapter provides in-depth information on the value co-creation subfield focusing on value definition, innovation and co-creation, and the service-dominant logic. Value co-creation and digital transformation have emerged because academics in both subfields have been discussing new questions raised by the advent of new technologies on how value from delivering new products and services can be captured. This chapter argues that these two subfields are converging to enable resource integration through similar sources such as platforms created through digital ecosystems. Working together, the two fields can improve their potential to find better solutions to improve the transformation process.

INTRODUCTION

Understanding digital transformation can be complex, not only because the nature of the field is multidisciplinary in academic debates in that it includes innovations, information systems, marketing, and strategic management, but also because practitioners from different silos or functional areas can also have different views. To understand the foundation of digital transformation, one should first investigate the meaning of digitization. Briefly, digitization is the conversion of atoms to bits, replacement of pictures with JPEG images, paper with electronic files, music with MP3s (Gobble, 2016), while digitalization is the transformation of all those things into process improvements that enhance customer experiences that go beyond traditional firm-customer interactions (Ramaswamy & Ozcan, 2016).

Digital transformation is the value creation phase either through a new business model or a new business logic based on all these efforts. Drawing on a vast amount of literature, Verhoef et al. (2021)

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identified the different phases, where digital transformation is the third and most pervasive of the three phases that starts with digitization followed by digitalization. Digital transformation has fundamentally altered consumers' expectations and behaviors (Lemon & Verhoef, 2016) and it has broken down the barriers among people, businesses, and things. Breaking those barriers means that people have the ability to create new products, services and find more efficient ways of doing business in response to all changes.

The phenomenon of co-creation has spread since Prahalad & Ramaswamy (2000) coined the term by recognizing the transforming role of actors and this new theory was defined as the joint creation of value by the company and the customer. Co-creation was defined "*as an active, creative and social process, based on collaboration between producers and users that is initiated by the firm to generate value for customers*" (Roser et al., 2009, p.9). Value co-creation in the contemporary world has evolved together with the capabilities and ubiquitous elements of the virtual world and digital transformation will accelerate the intense cooperation between firms and consumers that leads to mutually beneficial relationships (Belk & Llamas, 2013).

DIGITAL TRANSFORMATION

Digital economy has been described as an era in which intelligent machines and people were connected through technology and it '*emerges through countless, diverse, dispersed and uneven processes of digital transformation, which consist in changing how the consumers, employees, markets, enterprises, and other organization's function'* (Śledziewska & Włoch, 2021, p.3). The digital economy builds upon the internet economy, and it takes connectedness into an upper level via digital products that have four main layers as device (hardware), communication (network), service (software) and content (data and information) by extraordinary pace of innovation.

Although digital transformation is a hot topic and there is a plethora of scientific literature on the subject, the topic remains scattered. As Parviainen et al. (2017) argued, the context is limited to specific sectors such as healthcare, transportation, education, retail, manufacturing, smart cities or public services and a significant number of articles focus on digitalization-induced changes that affect business models. Digitalization is not only a hot topic among academia, but also a contemporary issue that needs to be addressed by practitioners, which is also evident in many conferences and white papers. It has been studied through frameworks (Hagberg et al., 2016) and as a journey with learning and challenges (Quinton & Simkin, 2016), but a fundamental shift in focus is needed to study the impact of digital transformation on society in a wider context. Digital transformation changes the ways of working, roles, and the business models and it is analyzed through these domains. Even though it fundamentally changes societal structures, this is the end process and there is little scientific research on the spectrum of changes in the areas of human society (Parviainen et al. 2017).

Verhoef et al. (2021) reviewed the literature on digital transformation from different fields and provided strategic imperatives and a research agenda. According to the authors, digital transformation has been analyzed from the perspective of different business disciplines; while marketing researchers have reviewed the change from the *digital marketing* perspective (Kannan & Li, 2017), research in the *strategic management* literature has mostly focused on business models (Osterwalder & Pigneur, 2010), and the *information systems* literature has discussed the technological development that underpins the transformation (Sambamurthy et al., 2003). There is a plethora of literature on the strategic management

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stream since the conceptualization of business models have has attracted interest from both academics and practitioners.

Phases of Digital Transformation

More than two decades ago (Negropante, 1995), digitization was described as the conversion of analog to digital information and processes. Digitization is still defined (Yoo, 2010) as the conversion of analog information into digital format; however, it now comprises more than the increasing use of digital technology. Digitization does not solely imply the form but also the process of digitizing (Parviainen et al. 2017).

Koch and Windsperger (2017) interpreted digitization as a process that goes beyond the mere technical aspect of information in digital form. More than a decade ago, Tilson et al. (2010a) studied the pivotal role of digital infrastructures in shaping the future uses of IT and they distinguished (2010a, p.2) the term *digitizing* - a technical process from *digitalization* – as a sociotechnical process of applying digitizing techniques to broader social and institutional contexts. At that time, they discussed the evolution of digital technologies, how the potential of digital tools could be unleashed, and the increasing capability of digital devices in communicating, storing, and processing many types of information and the blurring boundaries among different sectors that are increasingly connected by a common infrastructure. Based on the definition (Tilson et al., 2010a) of organizing logics which are interconnected by a digital infrastructure, Koch, and Windsperger (2017, p.5) claimed that *digitization* can be better defined as the "socio-technological process of applying digital technology across industries and contexts in ways that affect and shape their underlying infrastructures for the creation, storage, and distribution of content, applications, and services". This was one of the first socio-cultural interpretations of the term digitization that paved the way for the convergence of technologies such as media, storage, and distribution that merge on the ubiquitous network. Digital objects are dynamic and loosely coupled products that can be combined in novel ways. From the technical side, e-books may only represent the digital replacement of conventional books; however, the model of content creation and production characterize and form the basis of the social information of modern society (Tilson et al., 2010b).

Digitization is also defined as the "encoding of data in digital formats" (Gölzer & Fritzsche, 2017, p.1333) in its literal sense. The increasing use of Big Data within business structures evolved based on new data processing capabilities. Even though the diffusion of progress in digital technologies has been quick over the last decade, it has not penetrated throughout all fields with the same speed. The term Industry 4.0, which was first introduced at a German industry fair in 2010, is used together with digital transformation to denote its revolutionary potential. Big Data, characterized by the 3 V's - volume, variety, and velocity (Chen, Mao & Liu, 2014) has shifted the attention from efficiency and effectiveness in production processes to the management of data and will continue to drive the context of digital transformation.

Digitization and big data analytics defined as 'datafication' affect all areas of life, creating new ways of cooperation in terms of the interactions between objects that enable easier transactions and create massive amounts of digitized data. Loebbecke & Picot (2015) highlighted the impact of digitization on business models and the resulting societal transformation and included big data analytics since it serves to analyze any kind of digital information within the scope of today's products and services. Digitization and big data analytics challenge business models in traditional, established industries, which has resulted

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in disruption. By exploiting digital disruption channels, innovative start-ups pursue new opportunities facilitated by many desirable changes (Lucas et al, 2013).

Parviainen et al. (2017) proposed an academic model that signifies how benefits can be gained from digitalization in practice, which focuses on how digital transformation can be achieved in a company through its positioning. The model is divided into four steps, where the first step comprises four sub-steps (digitalization impacts, digitalization drivers, digitalization scenarios, and digitalization goals) that analyze the potential impact of digitalization for the company. The second step involves a review of the current state in comparison to the desired position and this step also encompasses two sub-steps (analyzing the impacted areas and situation with respect to the desired goals). The third step can be defined as the roadmap that builds the approach that will be adopted to close the gap between the current state and the desired position. Finally, the implementation step validates the actions and returns to the previous stage if needed.

Digital transformation (DT) is defined as the "process of reinventing a business to digitize operations", "the use of technology to radically improve the performance of enterprises", "the deliberate and ongoing digital evolution of a company business model, idea, process, or methodology, both strategically and tactically" (Schallmo et al., 2017). These definitions comprise reinvention, evolution, performance outcomes and networking dimensions using technology. Thus, it can be concluded that the application of new technology is a medium used to extract data into an actionable information, but the core lies in models, process, and strategy.

Digital Transformation Strategies

The ability to digitally transform a business is dependent on a clear digital strategy that is supported by leaders who foster a culture that enables new inventions. For some companies, risk taking is a cultural norm, which is unique to digital transformation since they seek new levels of competitive advantage. Digital transformation strategies disrupt businesses in every industry by breaking down barriers and identifying efficient ways of doing business (Schwertner, 2017).

Companies in all industries explore new digital technologies to explore their benefits, which affect either their products, business processes, sales channels, or supply chains. Digital transformation strategies seek to coordinate these independent threads of digital transformation and in companies, senior managers such as CIOs (Chief Information Officer), CDOs (Chief Digital Officer) or CEOs (Chief Executive Officer) usually oversee and take the lead in digital transformation. The benefits of digitization can be summarized as increased sales or productivity, innovations in value creation, and/or new ways of interacting with customers, among others (Matt et al., 2015). Therefore, digital strategies are company-wide perspectives that cut across other business strategies such as operation strategies (products, markets, processes, and functional strategies (finance, human resources, IT). Matt et al. (2015, p.340) defined a digital transformation strategy as "a blueprint that supports companies in governing the transformation that arise owing to the integration of digital technologies". The essence of a digital transformation strategy comes from a business perspective that focuses on the transformation of products, processes, and organizational aspects. Digital business transformation is the application of technology to build new business models and is characterized as being outcome driven (Schwertner, 2017). Similarly, the overarching character of a digital transformation strategy was mentioned by Gobble (2018), who drew these conclusions from the book, *The Digital Edge* (McDonald & Rowsell-Jones, 2012). According to the authors, a digital strategy differs from marketing strategy or IT strategy in the sense that the tech-

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nology component cannot be treated in isolation as it encompasses all the organizational structures and functions. Digital technology reshapes the relationships of a company with all the stakeholders and extends further to create a digital edge. To find novel ways of creating value and revenue, both digital and physical resources are combined under the umbrella of digital edge.

There are four common dimensions of digital transformation strategies (Matt et al., 2015) that are independent of the industry or the firm: use of technologies, changes in value creation, structural changes, and financial aspects. The use of technologies differs depending on the capabilities of an organization and the current phase of digital transformation. Structural changes provide a basis for the new operations and financial aspects include a firm's ability to finance this endeavor and its ability to act urgently according to this new initiative. The changes in value creation directly affect the business model of the firm since that dimension denotes the deviation from the core or established business model. These four dimensions are interlinked and ensure the successful rollout of a digital transformation strategy.

Strategy always comes before technology since an organizational change happens when a company makes a transition from a current state to a desired state and plans this change with minimum employee resistance (Schwertner, 2017). Digital transformation is not solely about technology; if the businesses lack the mindset to change and the current organizational culture does not allow it, the transformation will not occur.

BUSINESS MODELS AND RESOURCE INTEGRATION

The global economy has altered the balance between customers and suppliers, and since the technology has evolved together with new communications and computing opportunities, the value propositions once present to consumers have no longer become viable. The growth of the Internet raised new questions regarding how value can be captured from delivering new products and services. The music industry is a typical example where the core business model has been challenged with the ubiquity of digital downloading and the ease of access to digital data. This new channel forced recording companies and performers to rethink the distribution of their services and the essence of their business model. This new environment created the need to capture value from consumer in different ways through new business models. A business model is considered as an organizational and financial architecture of a business (Teece, 2010). The essence of a business model lies in defining how the enterprise delivers value to customers and receives payments for that value.

Digital transformation has been a topic of discussion for many years, but the way in which business models should be digitally transformed is still not clear. A business model (Osterwalder & Pigneur, p.14) "describes the rationale of how an organization creates, delivers and captures value". The business model concept is developed to create a simple and relevant tool for a shared understanding in discussions among practitioners. The nine building blocks of the Business Model Canvas can be listed as customer segments, value proposition, channels, customer relationships, revenue streams, key resources, key activities, key partnerships, and cost structure. The Business Model Canvas is widely used by start-ups and early-stage entrepreneurs to translate their business plans into the business processes to ensure that the business plan is feasible and profitable. It is a blueprint and a reminder for businesses from any sectors that enables them to think holistically about their businesses. Apart from its common use as a business plan, the Canvas is also used to aid established companies restructure their value chain. Thus, with the Canvas, companies can either work on the impact of new ideas and solutions that can be embedded in

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their current business models or explore completely new growth opportunities and assess the use of new business models.

Similarly, Schallmo et al. (2017) defined a business model as the basic logic of a company that involves customer, benefit, value-added, partner and financial dimensions. The core of all business model definitions lies in the created value that enables a differentiation from competitors (Schallmo et al., 2017) or the reason why customers choose one company over another. Digital transformation enters the stage at this point since some value propositions are so disruptive that they might even cause changes in the business models of competitors. The digital transformation of business models can relate to either individual elements or the whole model and the degree of change is primarily dependent on the customer but can also have an impact on the business partners.

To understand what makes digital technology transformational, one needs to understand the underlying properties that rebuild the business models in many sectors. Digital signals can be transmitted perfectly (exact replication) and can be replicated indefinitely (infinite times), and the ability to achieve these two properties at zero marginal cost creates novel opportunities for both old and established businesses and new start-ups since it directly affects the scalability of operations (Iansiti & Lakhani, 2014). Even though the digital ubiquity started with software companies, the trend spread well beyond software companies as, in order to stay competitive in most sectors, ubiquitous connectivity is critical. In summary, digital transformation is the driving force pushing all type of businesses to compete in new ways and rethink their business models to create and capture value.

Traditional strategic models conceptualize competitive advantage as either a firm's positioning within an industry (Porter 2004a, 2004b) or non-imitative resources (Wernerfelt, 1984). Both perspectives lack validity in today's digital environments since they rely on analogue technology and non-digital products. Thus, there is a need for a new framework or model that can harness the capabilities of digital technology; Koch and Windsperger (2017) proposed the network-centric view as an alternative to traditional models of competitive advantage. The network-centric view facilitates the understanding of how entrepreneurs support digital platforms and play a critical role in the success of those platforms through their choices. The network perspective was adopted by Srinivasan & Venkatraman (2017), who theorized about entrepreneurial success in digital platforms. The scholars distinguished two types of networks: resource networks and module networks. Resource networks signify the relationships used to gain financial and human capital and funding opportunities that help firms develop their resource base. In digital platforms, the challenge for firms is to be able to access resources and develop relationships. The success criteria are twofold: first, the economic one where the necessary financial resources are gained in platform settings, and secondly, the social one where the platform setting provides legitimacy for the digital entrepreneur in a competitive environment (Srinivasan & Venkatraman, 2017).

Companies compete within ecosystems and, similar to how diverse species are interdependent in biological ecosystems (Moore, 1993), entities and firms are interdependent in business ecosystems. The digitization stage further increases the pace of the ecosystems perspective since digitization largely refers to the networking of all sectors in the society through the widespread usage of smartphones, cloud connectivity, and IoT, which has forced managers to focus on ecosystems as a pathway for growth (Niden & Spriggs, 2016). Digital ecosystems are powered by new technologies and their reach is far more expansive to the extent that they are even disrupting traditional industry structures. Some companies adopt new ecosystems, which is also referred as *digital transformation*, while others cannot embrace these changes since they are accustomed to their traditional way of doing business (Subramaniam et al., 2019).

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Subramaniam et al. (2019) proposed a framework for digital ecosystems and divide them into production and consumption systems. Production ecosystems focus on selling a product or delivering a service; conversely, consumption ecosystems evolve after a product is sold or a service is rendered. Production ecosystems represent a digital replica of traditional networks and are relatively easy to transform via digital technologies. The competition starts in consumption ecosystems where the businesses can enlarge the scope of their networks and add new actors to personify what is new about their business interdependencies. Traditional firms could miss out a potential growth opportunity if they ignore consumption ecosystems. This is usually what happens when Uber, Apple, or Amazon attack several consumption ecosystems through their platforms. Every company is at a different stage in their digital transformation journey, and it is a strategic decision for a firm to choose its digital replicas or digital envelopes through either production ecosystems, consumption ecosystems or both.

NEW TECHNOLOGIES AND DIGITAL PLATFORMS

The information systems literature also analyzes digital transformation from the perspective of the adoption and use of technologies and resultant business value. Information systems put agility to the forefront in the discussions regarding digitalization. Agility, or the ability to seize business opportunities, refers to the success of firms in enhancing and redefining their value creation (Sambamurthy et al., 2003).

Digitalization describes how IT or digital technologies can be used to alter existing business processes (Li et al., 2016) and change traditional firm-customer interactions. These changes occur with digital artifacts and IT serves as a key enabler in digitalization. The case of smart cities illustrates (Li et al., 2016) the emergence of new operations models together with the integration of information and communication technologies (ICTs) into urban infrastructures (Manville et al, 2014). Smart cities demonstrate the characteristics of new operating models after digitalization due to the new services that disrupt all the sectors and update existing models by unlocking city-based resources. The reason why smart cities redefine the characteristics of operations models lies in their scalability, analytical output, and connectivity. Smart cities require new operations models, digitized infrastructure, and a new mindset from citizens to enable operations with online connectivity in geographical proximity. Key characteristics of new operations models were defined by Li et al. (2016) and the degree of interaction has an important impact together with connectivity, which relates to the integration of information, systems, people, and services enabled through the IoT. The IoT can be defined as the integration of live real-world data through various devices such as kiosks, sensors, cameras, and appliances etc. Therefore, digitalization is based on digitized infrastructures as new ways for organizations to design products and services that are more customer centric. The development of new models enables the establishment of new boundaries of operations management in the digital economy.

Although a variety of digital growth strategies exist, as Verhoef et al. (2021) mentioned, the most prominent growth strategy involves the use of platforms. Digital platforms play an intermediary role between two or more users and facilitate exchange through technology e.g., price comparison sites, search engines, credit cards, online auctions, and online retail platforms, among others. Platforms are critical in the sense that they provide an infrastructure that enables value creation through distinct users by connecting them (Broekhuizen et al., 2021). The ubiquitous characteristics of digital platforms facilitate user participation and capitalize on network effects (Eisenmann, Parker & van Alstyne, 2006). Platforms possess varying levels of openness based on the degree of access of various actors, categories,

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and channels. Broekhuizen et al. (2021) defined five openness dimensions: three actor-based (suppliers, customers, complementary service providers) and two non-actor (categories and channels) dimensions.

Digitization has been mainly discussed in the manufacturing context and the previous literature has neglected the role of digitization in servitization, generally taking technology for granted (Coreynen et al., 2017). Companies can leverage digital methods to improve their service offering, and the use of digital methods aids different types of service innovation. Servitization means leaving behind the dichotomy of goods and services and moving to a hybrid bundle of systems that creates mutual value for all parties. Through the exploitation of ICTs to create seamless service experiences, digitization can be considered as a pathway to boost servitization (Coreynen et al., 2017). Servitization has become more digitalized (Vendrell-Herrero et al., 2017) and the high degree of digital adoption and innovativeness has coined a new form of innovation defined as digital service innovation (Opazo-Basaez et al., 2021). Digital service innovation is a novel form of technological innovation which is based on digitally enabled service offerings.

Since servitization refers to the transformation of manufacturing firms that offer bundles of services together with their products, the increasing use of technologies to connect people, systems and services offers several opportunities for manufacturers. In today's world, manufacturers not only apply digital technologies to boost their operations, but also modify their businesses combining physical and digital offerings. The use of digital technologies such as the IoT, digital platforms, big data analytics, and artificial intelligence has brought about both value-creating and revenue-generating outcomes within the service ecosystem (Vendrell-Herrero et al., 2017; Sklyar et al., 2019).

The role of information technology and the significant investment to leverage these technologies are shaping the competitive performance of firms. Firms not only compete for innovations in products and services, but the speed provided through technology enhances agility. Value creation and the convergence of technologies in terms of computing, communications and content pave the way for growth. The physical value chains are disrupted with digitalization and the strategic role of IT within the firm is heightened after the unbundling of information and the disaggregation of organizational structure (Sambamurthy et al., 2003). Information technology investments affect firm performance through either organizational capabilities or strategic processes and digital options are considered among those capabilities. Therefore, IT plays a significant role, which is reframed as the digital options generator in the contemporary world.

VALUE CO-CREATION

Consumer Value

Value has been the subject of numerous debates (Ng & Smith, 2012) and the notion of systemic value was first introduced by Hartman, who suggested that in terms of systemic value, goods have finite properties. Husserl supported the view that value can only refer to value that is experienced and suggested a phenomenological concept of objects, stating that they are more than an external thing, but rather a part of the individual (Ng et al., 2012). The economic foundations of value focus on exchange value and use value. Ng et al. (2012) identified the differences and the linkages between the two terms. They stated that although exchange value and use value are interlinked, the relationship between them is more complicated. Each scholar has provided his or her own conceptualization of value. Grönross (2008), stated that value-in use arises from customer's experiences as well as its own logic. Helkkula et

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al. (2012) argued that value-in-use is not only nourished from current experiences, but past and feature experiences that accumulate to form the whole value construct. Over time, value-in-use has evolved due to the commonality of ecosystems and their effect on broadening the scope of value-in-use to include the term value-in context (Vargo et al., 2008). Moreover, value is regarded as something specific to the context in which a job is performed (Bettencourt et al., 2014; and Barney, 2001). According to Lusch and Vargo (2014), value-in-context refers to the density dimension in service ecosystems due to the change and adaptation of ecosystem to the requirements of time, space, and conditions.

In the current era, the market is no longer an avenue for exchange and consumers showcase their resources in order to trade them for any kind of reward e.g., social recognition, respect from peers, among many. The firm seems to lose its privilege of producing value but rather the market value is shared between the firm and the customer disproportionately. Consumers seem to have more control, but since companies create 'platforms for action' that facilitate interpersonal ties while sustaining the spirit of communities', value co-creation in virtual environments is an illusion of the consumer control of the market (Belk & Llamas, 2013).

The Concept of Co-creation

The term co-creation was first coined by Prahalad and Ramaswamy (2000), who stated that co-creation is the "collective act of creation where consumer participation is a competence" in company activities. They also defined co-creation as the "joint creation of value by the company and customer" (2004 a, p.8). Vargo and Lusch (2004a) described the term as everything offered by firms that constitutes services that bring value to consumers rather than goods. Prahalad & Ramaswamy (2000) argued that co-creation is not the transfer of activities to customers, nor it is the customization of products or services. Roser et al. (2009, p.9) defined co-creation as an active, creative, and social process," based on collaboration between producers and users that is initiated by the firm to generate value for customers". According to them, consumers are no longer the passive recipients of firms' offerings but have the capacity to reject those offerings by their experience and knowledge. Customer participation in value co-creation is among the themes of innovative thinking in services marketing (Russell-Bennett & Baron, 2015). Ostrom et al. (2015) claimed that co-creation is an interdisciplinary area that is characterized by the inputs from many actors based on their different roles and resources.

Co-creation has transformed the roles and relationships of customer and companies. They now engage in inactive dialogue with each other to build their own experiences. Customers are not the only actors in the co-creation process, as there are also non-customer stakeholders. Norman and Ramirez (1993) were the first to highlight the roles of non-customer stakeholders in creating value. Co-creation is dependent on technological innovations and innovations can refer to many different things including scientific inventions, patents or even the discovery of a simpler way of doing things. Lee et al. (2012; p.818) defined innovation as "any new idea or approach that is applied in fundamentally different ways to create value for the organization and other stakeholders such as customers, suppliers, partner organizations, communities, governments, or even general good of humanity". In this respect, value creation is the heart of innovation and the main aim of implementing a digital transformation.

Consumers in the co-creation process are more knowledgeable about the information related to their needs and firms have information to solve those needs (O'Hern & Rindfleisch, 2010). Consumers have assumed more active roles enhanced by technological advancements, primarily the Internet. The Internet has increased consumer access to knowledge and facilitated their ability to apply this knowledge

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through a variety of online tools (Prahalad & Ramaswamy, 2004a; Thomke & von Hippel, 2002; O'Hern & Rindfleisch, 2010). Companies can also use alternative digital channels for consumer engagement, primarily social networking platforms to stimulate idea generation.

Innovation is considered as a very important strategy for all firms, non-profit organizations, and governmental agencies. In the traditional perspective, organizations produce products and services and develop plans to sell them; on the other hand, in modern society, the end-users know what they want and contribute to the process of value creation. Throughout this process, enterprises collaborate with all stakeholders, particularly with customers. This new approach to innovation contributes to the creation of shared value between all stakeholders, as firms create many disruptive innovations that exist outside the traditional way and consumers themselves find new innovative ways of creating value.

Service-Dominant Logic

In the traditional economic model, the exchange of commodities was the primary source of the economy. For decades, this goods-dominant marketing model prevailed. Vargo and Lusch (2004a) examined and analyzed this goods-dominant paradigm and proposed their own service-dominant paradigm, later called service-dominant logic. The goods-dominant logic comes from the systematic study of businesses and was based on the notion that tangible goods could possess value and can be transported and exchanged for other goods. Lusch and Vargo (2014) stated the that goods-dominant mindset is completely mistaken, and it is myopic when dealing with today's complex and technologically driven world. The new service-dominant logic is based on several different aspects. Penaloza and Venkatesch (2006), listed those aspects as the primary unit of exchange, the determination and the meaning of value, the role of the consumer, the nature of the interactions between businesses and customers and the origins of economic growth. In goods-dominant logic, emphasis is based on physical products and the producer determines the meaning of value; thus, the customer is only the recipient of value. Conversely, in service-dominant logic, the role of the customer is changed from being the only recipient of value to the co-creator of value. In short, the meaning of value is also perceived and determined by the consumer and wealth is created by both consumers and firms.

Lusch and Vargo (2014) argued that firms are not the main actors, as humans become the key actors in service-dominant logic because they combine resources from various market-facing, private and public sources. Human actors as end-users also contribute to the well-being of other actors. Lusch and Vargo believed that the service-dominant logic has a significantly important role in replacing the goods-dominant logic of marketing. They also outlined the specific disadvantages of goods-dominant logic and shared their ideas on service-dominant logic with a common language and terminology that is shared by the people who constitute the community. They used four main concepts that commonly used by actors, namely norms and resources, service, and value.

Lusch and Vargo (2014, p.56), specified the actors as "entities that have agency, the ability to act purposefully", but their actions are constrained by norms and other institutions. With their own baggage and unique resources, each actor makes a real contribution to the system. For many decades, only natural resources such as land, animals, plants, and minerals were considered as resources. Goods-dominant logic was developed around those resources. However, Vargo and Lusch (2004a), asserted that for decades, the importance of resources and people were limited, and skills and knowledge have become the most important type of resource. Services could be in the form of goods or currency that provides a means to

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reach future service (Lusch and Vargo, 2014). Value is the backbone of the service-dominant logic in which it is considered as a benefit that that is always co-created.

Value creation come into existence through a service system and different scholars have conceptualized the basis for resource integration under value-creating systems. Lusch and Vargo (2014, p. 161) defined the notion of a service ecosystem as "a relatively self-contained, self-adjusting system of resource-integrating actors that are connected by shared institutional logics and mutual value creation through service exchange". Chandler and Vargo (2011) also thought that service ecosystem analyzed the value creation process in a broad system that offers a meta layer of analysis. In service-dominant logic, institutions have taken a different broader role and represent the building blocks of resource-integration activities in service ecosystem.

There is a consensus that in the value creation process, customers drive value through resource integration. Resource integration is described as the means through which actors use their knowledge and skills to create value. Resource integration is an interactive process that aims to harmonize the interests and needs of different actors that cannot be easily realized (Kleinaltenkamp et al., 2012). In summary, the integration of resources paves the way for collaborative value creation (Wieland et al., 2016).

The main philosophy of service-dominant logic challenges all stakeholders such as customers, employees, and partners to act collaboratively since all these stakeholders are exchange partners in the value co-creation process. The role of actors in shaping value co-creation activities is an important area of research. Wieland et al. (2015) emphasized that not only do salient actors such as customers and firms drive value, but a diverse set of actors generate change.

CO-CREATING DIGITAL TRANSFORMATION

Digitalization has affected almost all industries and competition in the digital era has taken the form of competition for innovation. It is believed that innovation today is not a luxury, but an obligation. Co-creation and the transition of digitalization have affected the interpretation of the nature and extent of collaborative work. Digital ecosystems are a part of service ecosystems and different scholars conceptualize the basis for resource integration under various value-creating systems, including value constellations (Norman & Ramirez, 1993), value networks (Lusch et al., 2010), configuration of resources (Spohrer et al., 2007), and service ecosystems (Vargo & Lusch, 2011). Value creation come into existence under these systems and when co-creation and digital transformation strategies and tools are used together and interchangeably, the performance metrics of companies will increase unexpectedly.

The enhanced access to the internet through the digital devices contributes to the growth of networks connecting people, companies, public institutions, machines, and systems that. become the source of data in their own right and the emergence of the new platform business (Śledziewska & Włoch, 2021). Customers can design a product, modify a product feature, engage in promotional activities, or write reviews to co-create value with other actors (Broekhuizen et al., 2021). Customer openness refers to the degree of access that customers have to a platform and some platforms even enable customers to co-create value by providing access to the production, marketing, and services phases.

Companies use new digital technologies to explore their benefits, which affect products, sales channels, business processes and supply chains. Digital technology reshapes the relationships between companies and all other stakeholders. Digital transformation is the application of new technologies to build new business models, processes, and software systems. The new technologies like mobile, social,

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cloud, analytics, and the internet of things (IoT) present new opportunities to companies. The application of new technologies has facilitated the development of new business models and digital technology has reshaped the relationships between companies and their stakeholders, reaching beyond the creation of a digital edge. Business models involve customer, benefit, value-added partners, and financial dimensions.

The differentiation of business models lies in the created value that explains the reason why customers choose one company over another. Global corporations such as Uber, Alibaba and Airbnb are dependent upon new digital technologies to reach their customers across the world. Those companies use digital technologies to reach their customers and offer products them and they do not necessarily co-create the digital experience. On the other hand, the digitalization outlook of firms denotes their readiness for co-creation in terms of the contribution to customers, firms, stakeholders, and the public at large. Those companies do not own any tangible resources, but they have vast amount of data to derive economic value out of it (Śledziewska & Włoch, 2021).

Contemporary technologic advancements, primarily the Internet, have enhanced the capacity of consumers to assume more active roles in co-creation. The Internet has increased consumer access to knowledge. They can now gather knowledge through a variety of online tools that connect individual consumers from different backgrounds with differing abilities that enhance their creative pursuits (Prahalad and Ramaswamy, 2004a; Thomke and von Hippel, 2002). The postmodern consumer is no longer solely content with the consumption process and as a co-creator, they acquire psychological benefits that would normally be unavailable to them through consumption alone (Firat, Dholakia and Venkatesh, 1995).

Co-creation is an indispensable aspect of the development of new products and is regarded as a collaborative activity in which consumers actively contribute to the content of a new product offering. This leads to many positive outcomes, such as improvement in the quality of products, increased market acceptance, and risk reduction, among others (O'Hern & Rindfleisch, 2010). From the company side, the benefits of co-creation are articulated under three main headlines; reduced risk of market failure, acceleration of innovation and establishment of an innovative organizational culture (Roser et al., 2009). Fuller (2010) focused on virtual co-creation and explored how consumers' personalities and motivations impact their expectations of the co-creation experience.

Hoyer et al. (2010) outlined that consumer co-creation is a conceptual framework that is focused on the level of co-creation in new product development. Through co-creation experiments, companies gain increased benefits or reduced consumer costs. On the consumer side, the positive outcomes can be summarized as productivity gains, improved effectiveness, reduced risk of product failure, increased speed-to-market, closer fit to consumer needs, better product differentiation, among others. Verleye (2015) summarized the consumers' benefits regarding the co-creation experience as hedonic benefits, cognitive benefits, social benefits, personal benefits, pragmatic benefits, and economic benefits. On the other hand, companies use social networking platforms to stimulate the co-creation process to obtain more benefits. They invest in communication to guide their customers to prepare them for their roles as co-creators.

Digital transformation is the driving force pushing all types of business to compete in new ways and rethink their business models to create and capture value. Digital technologies are therefore shaping the competitive performance of firms. Firms not only compete for innovation in products and services but also through new digital technologies. Companies can leverage digital methods to improve their service offerings and the use of digital methods aids different types of service innovation. Today, the increasing use of technologies to connect people, systems, and services offers various opportunities for companies. Consumers are more knowledgeable about the information related to their needs and there is a consensus that in the value co-creation process, consumers, firms, and other stakeholders integrate production pro-

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cess and use their knowledge and skills to create value. The main philosophy of co-creation challenges all stakeholders to act collaboratively. In this respect, value creation is both at the heart of innovation and the main aim of implementing a digital transformation.

In summary, digital transformation is the application of new technologies to build new business models, processes, and software systems. By applying digital transformation systems, businesses can become profitable, achieve a greater competitive advantage, and reach a higher level of efficiency. The digitalization outlook and degree of innovativeness of firms denote their readiness for co-creation and signal the level of success in terms of their contribution to stakeholders, consumers, firms, and the public at large (Kalkan, 2021). The intensification of datafication processes into new areas of economic, social, and political life is leading to a digital transformation which is paving the way for the emergence of a new model for the functioning of markets, enterprises, and households (Śledziewska & Włoch, 2021).

CONCLUSIONS AND MANAGERIAL IMPLICATIONS

The new technologies including social, mobile, analytics, the cloud, and the Internet of things [IoT] present both game-changing opportunities and existential threats to large established companies, because the revenues of these companies still come from traditional products and services. Many traditional firms have been suppressed by innovative fast-growing digital entrants and new online firms do not limit their reach to the traditional retail industry. With new digital resources, they can enter markets that were previously thought to be completely unrelated to retail in search of further growth opportunities (Wölmerth & Pagies, 2016). Recently, many firms in almost all industries have implemented a number of initiatives to explore new digital technologies and exploit their benefits (Matt et al., 2015). Companies where these technologies have become critical parts of the infrastructure, that are digitally mature, soon reported revenues and increased their market valuation in comparison to companies without a strong digital transformation vision (Schwertner, 2017).

Digital maturity is defined as effect of digital technologies in transforming processes, talent management and business models and the most mature organizations are those who are focused on transforming their business. In transforming their digital technologies, they focus on social, mobile, analytics and cloud computing. However, the important aspect compared to the adoption of new technology is the ability to foster a culture that drives change. The strength of any digital technology stems from the way the individual technology is transformed into the business system.

The main obstacles that seem to affect the digital maturity of a firm are the lack of strategy and competing priorities. Technologies can be used as a means to an end; however, companies that are in the early stages of digital transformation fall into the trap of focusing on technology rather than strategy (Kane et al., 2015). The first key managerial implication that is also imperative for small and medium-sized enterprises that lack the necessary resources for advanced programming skills is to start with cultural change and building their strategy on data-first focus. The future managers need to be equipped with prioritizing the data-first culture.

There are studies conducted that explore the link between digital transformation and value co-creation mainly from the information systems point of view in healthcare, banking industry, among many. A longitudinal study of an implementation of a digital monitoring technology in residential care enabled the success of a digital transformation case through co-creation (Dugstad et al., 2019). The study conducted in healthcare sector (Dugstad et al., 2019) identified that the success of the digital transformation process

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lies in applying co-creation methodology across different roles and professions which means involving all the actors in the process. The existing systems in service industries require advanced IT competence to be integrated into the provision of those services and co-creation methodology might act as a facilitator in the implementation. The facilitator role of co-creation methodology exerts another important managerial implication since managers need to monitor both the internal and external resources with a deep understanding of the facilitators in terms of the digital transformation they need to operate. In almost all sectors, it is important to re-evaluate the practices that either facilitate or create a barrier in the scope of customer experience.

Today's firms are increasingly engaged in co-creation of value with customers through use of self-service technologies and digital transformation is considered as a complex process that typically occurs over an extended period of time. During this extended period of time IT processes need to go hand-in-hand with business strategy applied within the corporate framework. Specifically, as Malar et al. (2019) indicate incorporating IT strategy within the conceptual framework of value co-creation process can provide a fruitful avenue for analyzing online services and attempts to align IT strategy with business strategy through focusing on the co-creation of value with customers to mitigate associated risks. Managerial insights and key takeaways are also drawn from the cultural aspect that affect both co-creation and digital transformation efforts. The managerial role assigned to the digital transformation and/or value co-creation also differs in companies. If both Chief Digital Officer (CDO) and Chief Information Officer (CIO) positions exist in a company, then they need to work collaboratively and share tasks in order to have a shared understanding regarding the digital transformation of their firms (Horlacher, 2016).

Digital transformation and value co-creation have both positive and negative consequences since they reshape the way of doing business with an observed profound effect on the society. From the company side, the benefits of co-creation can be articulated under three main headlines: *reduced risk of market failure*, *acceleration of innovation* and *establishment of an innovative organizational culture*. Therefore, the possible resistance to change is suspended through the buy-in from consumers who are active participants in the process. An innovative culture is also necessary for a digital transformation to flourish while executing the transformation process. The desirable outcomes of digitalization, such as growth of employment, increased productivity and increased consumer surplus exist; however, the critical societal changes cannot be ignored. Technology replacing human labor, substitution of labor within physical processes and even eliminating knowledge-based work processes to provide new digital products and services are among the drawbacks of digital transformation. On the contrary, a considerable number of new jobs are formed that outweigh the loss of others, particularly unavoidable cognitive processes.

The societal impact of digitization will be high since it is not yet viewed as only another revolution that institutions must respond to but a critical consequence that alters their core business model and destroys them (Loebbecke & Picot, 2015). Both value co-creation and digital transformation are well-suited for pursuing challenges such as resistance, failure, or any other negative consequences. In summary, it can be argued that the technological revolution is transformative, and it changes the defined rules, competition and even the character of products and companies. As digital transformation becomes ubiquitous, its consequences of replacing current business models, jobs and skills will be ubiquitous too.

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KEY TERMS AND DEFINITIONS

Business Model: The rationale of how an organization creates, delivers, and captures value.

Co-Creation: Joint creation of value by the company and the customer, an active, creative, and social process, based on collaboration between producers and users that is initiated by the firm to generate value for customers.

Digital Transformation: The deliberate and ongoing digital evolution of a company business model, idea, process, or methodology, both strategically and tactically.

Digitalization: Transformation of digital information into process improvements that enhance customer experiences that go beyond traditional firm-customer interactions.

Digitization: Conversion of analog to digital information (from atoms to bits, replacing picture with JPEG images, paper with electronic files, music with MP3).

Servitization: Transformation of manufacturing firms that offer bundles of services together with their products, the increasing use of technologies to connect people, systems and services offers several opportunities for manufacturers.

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Chapter 19
Digital Transformation Strategies for Small Business Management

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ABSTRACT

The objective of the chapter is to assess the role of digital transformation in small business management and specifically to evaluate the strategies suitable for small businesses, identify the underpinning theories, and highlight related empirical studies. Thus, several kinds of literature in the domains of information systems, strategic management, and small business management were extensively reviewed. It was discovered that small businesses are struggling with digital transformation. However, those that have adopted the system are benefitting immensely. It is therefore recommended that more attention be paid to those strategies that work well for small businesses; that tailor-made theories for small business digital technology adoption be developed; and more studies, specifically longitudinal studies, are required to appreciate the complexity of the problem and where interventions are required.

INTRODUCTION

Adopting digital transformation is unavoidable at this age and time if an organization must respond to the challenges of globalization and urbanization of economic activities. Organizations must modernize by integrating their activities with a new digital environment, which allows them to develop solutions to complex problems through digital transformation. However, there has to be an appropriate theory, aided by a suitable model, and buoyed by a winning strategy. This has largely been effective with large organizations, but not with smaller ones. Small businesses tend to have insufficient digital capabilities, resources, and funding, and thus cannot digitally transform easily.

Digital transformation is the integration of digital technologies into all areas of business processes (Boneva, 2018; Liu et al., 2011), fundamentally changing how they operate and deliver value to customers. As a process, it aims to improve an entity by triggering significant changes to its properties through

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combinations of information, computing, communication, and connectivity technologies (Vial, 2019). There is therefore a compelling need for businesses, specifically, small businesses, to evolve strategies to cope with the changes and compete favorably.

Small businesses tend to adopt information and communication technologies relatively slowly and ineffectively for several reasons and some scholars have appreciated the situation and are proposing an impressive range of theories, such as the technology acceptance model (TAM), the technology, organization, and environment (TOE) model, and the united theory of acceptance and use of technology (UTAUT) to better explain the interplay. Other scholars are developing theories and models that are tailor-made for small businesses. Furthermore, several scholarly studies have been published with research results that have buttressed the point, highlighted potentially effective strategies, and provided the nature and strength of the relationship between digital transformation and small business management.

It is for these reasons that this chapter is conceived to contribute to the growing discussion in strategic management and information systems literature on the subject under review. Therefore, the main objective is to assess the role of digital transformation on the management of small businesses and specifically to evaluate the strategies suitable for small businesses under the circumstances, identify the underpinning theories, and highlight related empirical studies germane to the phenomenon under review.

BACKGROUND

The specific definition of a small business varies by country, and industry, but incorporates annual receipts and the number of employees. During economic downturns, small businesses are excessively affected when resources are limited (Liu & Parilla, 2020), but often have the advantage of personalization to and proximity with customers. Despite the advantage inherent in small businesses, when it comes to adjusting to environmental forces like technology, they struggle to adjust because of their unique characteristics of small scale.

The gradual imposition of digital technology on small business management requires a paradigm shift from the old and reliable analog system to the new, unknown and untested digital system. The availability of these digital technologies and their inherent advantage has endeared many organizations to transform their processes, products, and/or structures. Since the aim of digital transformation is to address challenges regarding efficiency and effectiveness, it is still early days to know if organizations that do not quickly develop and implement digital transformation strategies would be able to compete in the new digital reality (Hess et al., 2016). Digital transformation provides an opportunity for businesses to leverage digital technology so that they can deliver a cutting-edge user experience to their customers and other stakeholders, and it has created opportunities for all businesses to compete equitably. However, small businesses have yet to enjoy the full benefits because of their set of unique characteristics.

Small businesses are critical to the survival of many economies worldwide. They represent more than 90% of all businesses, about 60-70% of employees, and 55% of GDP worldwide (Arnold, 2019). However, the challenges of this sector are intimidating. The poor rate of adoption of digital technologies is emerging as a foremost challenge. Globally, nearly 3 billion people remained offline, the vast majority concentrated in developing countries. Close to half of the world's population are not using mobile internet, despite living in areas with mobile broadband coverage, while a billion people in the world cannot verify their identity which limits their access to digital resources, and the usage gap remains a challenge (World Bank, 2022). The World Bank's digitalization strategy has previously focused on

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telecom infrastructure and services, but now covers digital skills development, e-commerce, digital identification, and cybersecurity (Cheney, 2022).

More attention is paid to large companies to the detriment of smaller ones when it comes to support, application, and cost-effectiveness. Stakeholders, particularly, scholars tended to focus attention primarily on the actions and reactions of large businesses to the evolution and adoption of digitalization, while overlooking or underestimating the rich potential in small business development. Today, digitalization is on the cutting-edge of technology making possible advances in Internet of Things (IoT), robotics, 3D printing, artificial intelligence, augmented and virtual reality, and so on, and the prospect for the future is full of infinite possibilities. Research are ongoing to improve existing digital technologies and there are efforts to develop new ones that will be faster, cheaper, and more user-friendly. Business management will benefit enormously from these developments.

Meanwhile, unlike big businesses, small ones do not have the capital to invest in digital technology, hence the difficulty in adopting new technologies and digitalizing their activities. Notwithstanding small businesses' agility, they do lag behind in adopting and exploiting the opportunities of new digital tools. Furthermore, businesses in developing economies have generally been slow to adopt new technologies to boost productivity despite many governments' initiatives to promote digitalization. For instance, despite the increase in internet usage among the population, less than 25% of SMEs in the Middle East, North Africa, Afghanistan, and Pakistan (MENAP) had online web (Kergroach & Bianchini, 2021).

The argument as to the merits or otherwise, or even the efficacy of transforming the management process digitally has been raging for some time, and evidence is pointing to the significance of such integration. Beginning at the end of the last century, digital transformation is perceived to have significantly affected business management in general. Unfortunately, further evidence of the application of digital transformation is noticed in large and successful organizations, while developments at the small business level are ignored both in theory and in practice, this is despite their aggregate superior contributions to GDP, employment generation, innovation, etc.

METHODOLOGY

To achieve the above-stated objectives, several kinds of literature in the domain of information systems, strategic management, and small business management, were extensively reviewed in an attempt to establish a concrete link between digital transformation as a management tool that underlies the management of a small business.

LITERATURE REVIEW

The two broad concepts in this review are small business management and digital transformation. These would be presented in this section, as well as other related concepts such as digital technologies, and management tools.

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Small Business Management

Although it is challenging to establish a global definition, categorizing small businesses based on the number of employees, turnover, assets, or combinations of those criteria is quite acceptable globally (Scheers, 2011; SMEA MOEA, 2020). Small businesses have contributed to the economies of many nations, and in many cases have become the mainstay of such economies (Ayyagari *et al.*, 2014; Karadag, 2016; Li *et al.,* 2012; Muller *et al.*, 2014; OECD/ERIA, 2018; SMEA MOEA, 2020). Small businesses are characterized by flexibility, dynamism, alliances, informality, and less bureaucracy (Ulas & Calipinar, 2013). However, they do have challenges. Small business management, therefore, is the process of aligning and coordinating all aspects of a small business, such as employees, suppliers, finances, customers, etc.

Challenges Facing Small Businesses

It has been reported that only 6% and 2% respectively small enterprises in EU member states recruited or tried to recruit personnel for jobs requiring specialist ICT skills in 2015 (Eurostat, 2017). Small businesses have higher digital innovation barriers than large businesses due to their limited resources and lack of capabilities (Ramilo & Embi, 2014). Thus, lack of digital capability, lack of human resources, technical barriers, limited access to funding, lack of managerial skill, lack of technology capabilities, limited access to raw materials, and restricted infrastructure availability, restrain them from expanding and growing their business (Chen et al., 2021; Coluzzi et al., 2015; Wang, 2016) and the consequences of COVID-19 pandemic have collectively restricted their growth and development.

Innovative Strategies for Small Businesses

The more significant use of digital transformation has been driven by innovation accelerators, such as Internet of Things (IoT), robotics, 3D printing, artificial intelligence, augmented and virtual reality, security, simulation, horizontal/lateral software integration, cyber security, blockchain, nanotechnology, cloud computing, big data, etc. Innovation is essential to economic growth because it makes technology cheaper. Most small businesses are at the stage of digitally maturing organizations, that are committed to transformative collaborative cultures that are open to taking the risk, and have access to the resources they need to develop digital skills and know-how, which requires a clear digital strategy (Kane et al., 2015), and is valuable only if it drives resource allocation and capital investments. Though constrained by scarce resources, small business managers still have at their disposal game-winning management tools.

Management Tools

A management tool is an entity of instruments that support the implementation of concepts and ideas at all levels of management, ultimately aimed at supporting the entire organizational process (Nedelko et al., 2015). Strategic planning, customer relationship management, customer segmentation, benchmarking, mission and vision statements, core competencies, outsourcing, business process reengineering, employee engagement survey, big data analytics, and digital transformation are some of the frequently cited management tools (Rigby & Bilodeau, 2015), and they are used to help run businesses effectively and efficiently to achieve organizational goals. Although some studies have found the influence of management tools on small businesses to be significant (Kim, 2016), others discovered that such tools are

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perceived to have little to no implementation in small business management (Johnson & Schaltegger, 2016). Evidence is increasingly pointing to the importance of the tool in business management.

Digital Technologies

Achieving operational excellence is at the core of most digitalization efforts. Ultimately, this translates into an improved cost position and efficiency. Potential benefits of digitalization include increases in sales or productivity, innovations in value creation, as well as novel forms of interaction with customers, and as a result, an entire business model can be reshaped or replaced (Downes & Nunes, 2013). To achieve these objectives, companies engage in activities toward standardizing and automating their business processes.

Digital technologies have been a key driver of business model innovation, allowing firms to deploy a wider range of business models than previously at their disposal, and organizations need to integrate these technologies and their capabilities to compete and strive in the digital world. Digital technologies present both opportunities and threats to companies whose success was built in the pre-digital economy because these technologies have transformed the business model by reducing operating costs (Chen, 2020), and their applications provide operators opportunities for a new broader boundary (Monllor & Soto-Simeone, 2019; Nambisan et al., 2019). Digital technologies have become drivers in the development and progress of small businesses (Li et al., 2016; Reuschke & Mason, 2020), and they allow them to collaborate to develop new innovative products or services aligned with customer demand (Lin et al., 2020). It also allows small businesses to improve market intelligence and access global markets and knowledge networks at a relatively low cost.

Among the biggest emergent, digital technology trends that are driving dramatic changes in many organizations are cloud computing, social media, mobile technology, and big data, which have a significant role to play in digital transformation (Bharadwaj et al., 2013; Fitzgerald et al., 2013; Lucas et al., 2013; Wade, 2015). Therefore, digital technologies are considered one of the main digital transformation drivers. However, solely applying digital technologies is not enough to drive digital transformation. Rather, a firm must have sufficient digital capabilities, digital strategies, and competitive advantage to ensure successful digital transformation (Berghaus & Back, 2017; Ezeokoli et al., 2016; Piccinini et al., 2015). Yet, many obstacles can prevent a small business from adopting and implementing digital technologies. These barriers can range from technical, regulation, data, organizational, culture and management, economic and financial, to markets. Yet, digital technologies have enabled a rapid pace of product and service innovations, shorter product life cycles, and cross-boundary industry disruptions, which require new forms of business strategies (Setia et al., 2013).

Digital Transformation

Digital transformation focuses on increasing harmony among business functions to generate improvement in products, services, and business models by leveraging digital technologies (Hess et al., 2016). It is a rapidly changing industry and offers society scale, scope, and speed to transform organizations, and is a disruptive technology that increases productivity (Bharadwaj et al., 2013; Ebert & Duarte, 2018; Gregory et al., 2019; Lucas et al., 2013).

Digital transformation aims to restructure the organizational business through the introduction of digital technologies, thereby achieving benefits such as productivity improvements, cost

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reductions, etc. In the digital economy era, small businesses struggle to compete in a rapidly changing and dynamic market. Therefore, through digital transformation, small businesses seek to increase their competitive advantage, improve business performance, and achieve business growth (Berman, 2012) and provide them new opportunities to enhance their competitiveness in local and global markets, through product or service innovation and improved production processes. However, the more limited resources available to them often prevent them to perform the digital transformation, primarily because of data security issues, lack of interoperability with existing IT systems, and lack of control (Schwertner, 2017).

The effects of digital transformation are not evenly distributed across countries and regions of the world. Asia for instance is at the forefront of digital transformation, while the developed countries such as the United Kingdom or the United States are forced to revisit their digital strategies, in order not to lose ground to their competitors. Apart from its geographical disparity, digital transformation can affect many business areas within an organization and many stakeholders and their focus vary from the adoption and use of new technologies; to improvements in processes, operations, customer relations, and performance; to the creation of new business models; and possible outcomes and impacts on several actors and environments (Kraus et al., 2022; Kwon & Park, 2017). Digital transformation is however not without its difficulties.

Challenges of Digital Transformation

Lack of resources is one of the characteristics related to small businesses that pose a big challenge in the adoption of digital transformation in the sector. Furthermore, digital transformation involves an investment of enormous amounts of money, without any guarantee of return (Sundaram et al., 2020). Other challenges are: political and structural challenges, scale, scope, and regulation (Midtun & Piccini, 2017); the absence of appropriate models for efficient business data processing (Yang et al., 2017); and the lack of recognition of how digital transformation benefits all of society, a shortage of skills and a qualified labor force, lacking or insufficient infrastructure, missing or inadequate regulation and consumer protection, and poor access to funding, particularly for small and medium businesses (Ebert & Duarte, 2018). Not all the difficulties faced by small businesses in this respect are resource-based, some can be attributed to the general aversion to change. These challenges can in part be mitigated by the development of shared values, channels, and approaches to interact with customers, vendors, and partners (Chaffey et al., 2019), and to increase the chance of success, organizations should apply the technologies to create innovation in products, services, processes, and business models (Curraj, 2018; Sundaram et al., 2020).

Digital Transformation Strategies

Firms must find ways to innovate with digital technologies by devising strategies that embrace the implications of digital transformation and drive better operational performance (Hess et al., 2016). Before adopting digital transformation, organizations should first consider their business orientation as well as their business strategies. Digital transformation strategy is a central concept to integrate the entire coordination, ordering, and application of digital transformation within a firm (Matt et al., 2015). These strategies focus on the transformation of products, processes, services, business models, and organizational aspects due to new technologies, and are a blueprint that supports companies in governing the transformations that arise owing to the integration of digital technologies, as well as in their operations after a transformation (Matt, et al., 2015).

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A digital transformation strategy is therefore a detailed plan for using digital solutions to improve the physical aspects of business entities. However, some companies are slow to respond to change, which decreases their ability to implement any meaningful digital transformation strategy. Lately, firms have grown interested in almost all industries to launch initiatives to explore new digital technologies and exploit their benefits. However, it will involve changes to key business operations and the need to establish management practices that will govern these complex transformations. An important approach is to formulate a digital transformation strategy (Matt, et al., 2015).

For a very long time, the high cost of enterprise software did not justify the adoption of digital technologies by small businesses. Thus, most were completely excluded from the digitalization process. However, programmers and vendors are gradually marketing tailor-made software for small business operations at affordable prices. Furthermore, small businesses with limited resources and inadequate capabilities can accomplish digital transformation by adopting third-party digital platform services (Li et al., 2018).

One of the digital transformation strategies that have worked for small businesses is improving collaboration among employees to guarantee unified operations. Another one is to automate tedious tasks. Another is to take data-backed informed decisions, prioritizing customer expectations. Others are: Assigning roles and responsibilities among your staff; proper budgeting and time management, prioritizing areas of the business where digitalization is required, seeking expert advice, partnering with the right technology and service partners, customer engagement, and digitized solutions (Sebastian et al., 2017).

Digital transformation has assisted small businesses by streamlining functions with automation, ensuring accuracy and preventing errors, helping in making informed business decisions, saving time and money, and creating a collaborative environment. However, it should be noted that it is strategy, not technology that drives digital transformation (Kane et al., 2015)

Digital Transformation Business Models

A business model is a template of how a firm conducts business, delivers value to stakeholders, links factors and product markets, and what benefits are provided to customers and partners (Schallmo, 2013). Classic business models have been disappearing and substituted for business models which are flexible, changeable instantly, have real-time responses to consumers' habits, and are knowledge-based. It becomes a digital business model if changes in digital technologies trigger fundamental changes in the way business are carried out and revenues are generated (Veit et al., 2014). Digital technologies have been identified as a key enabler of new business models (Zott, et al., 2011), and these technologies have facilitated pervasive changes in business models.

Although digital transformation is a widely known concept, a universally accepted business models based on the existing technology are missing (Schallimo et al., 2017). However, entities now have the opportunity to radically change their business models with new digital technologies, which mostly involve changes in the core business operations and modification of products, processes, and organizational structures (Matt et al, 2015). The model of Osterwalder and Pigneur (2010) has become very popular because of its graphical format. However, there are huge differences in the components selected as parts of these models.

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Digital Transformation and Small Businesses

Perhaps as a result of the growing influence of small business contribution to national economies, and the availability and affordability of digital technologies, there is an emerging interest in the role of digital transformation on small business management and lately and several scholars have indeed worked in this direction.

Mandviwalla and Flanagan (2021) outlined a rapidly conceived and implemented research project to digitalize small businesses in the context of the Covid-19 pandemic. Olayinka and Wynn (2021) examined how digital transformation is impacting businesses in both the developed and developing worlds, with a specific focus on the small business sector in Nigeria.

Crupi et al. (2020) examined if and how European digital innovation hubs, playing the role of knowledge brokers, can support the digital transformation of SMEs by triggering open innovation practices. Fachrunnisa et al. (2020) assessed the role of agile leadership and strategic ñexibility to improve the digital transformation of SMEs in ASEAN countries. Anim-Yeboah et al. (2020) investigated the concept of the digital transformation process and related capability implications for SMEs in developing economies, specifically those on an e-commerce platform in Ghana.

Bouwman et al. (2019) examined whether European SMEs that undergo digital transformation perform better if they allocate more resources for business models. Ulas (2019) provided a comprehensive view of the factors affecting the digital transformation process of the manufacturing sector in Turkey and describes the programs and software that SMEs can use to perform digital transformation as well as the inherent benefits. Pelletier and Cloutier (2019) explored the group conceptualization and perceptions about information technology (IT) issues within an ecosystem that includes entrepreneurs, IT professionals, and socioeconomic support professionals. Casalino et al. (2019) studied the effects of digital strategies and organizational performances on SMEs in the age of coronavirus while balancing digital transformation with an effective business resilience. Mubarak et al. (2019) studied the impact of digital transformation on business performance in the cities of Karachi, Lahore, Peshawar, Islamabad, Gujrat, and Sialkot, Pakistani SMEs. Curraj (2018) examined the business digitalization of SMEs in Albania, especially on the premise of innovative approaches and their impacts on performance. Rassool and Dissanayake (2019) evaluated the role played by the digital transformation for SMEs in Sri Lanka.

Chen et al. (2016) examined the effect of the pilot implementation of an industry-specific web portal as an IT resource on the performance of SMEs in the Taiwanese textile industry. Toanca (2016) uncovered opportunities for Romanian SMEs across seven industries, to benefit from the diverse digital tools that are now within their reach to become successful in the global and European markets.

Digital Transformation Tools in Small Business Management

The advent of digital technologies had altered the traditional process of planning, organizing, leading, motivating, staffing, controlling, and decision-making in many organizations. Similarly, activities like marketing, financing, customer care, procurements, and accounting have been greatly affected. Today, digital tools are deployed to perform activities and tasks that were hitherto the preserve of man, and proponents point to many instances of better performance to justify their optimism. Digital tools are online platforms or software applications leveraged by businesses or individuals to perform quick and optimized functions hereunder are presented a few examples of the application of these tools that are transforming the small business management processes.

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1. Chat and collaboration tools such as *Slack* make communication with different teams a lot easier by integrating with over 2,400 other apps to avoid miscommunication problems. It is integrated with all major project management tools and office management, sales, productivity, developer, and design tools.
2. For video conferencing services *Google Meet* might be a better alternative for a small business. Its free plan has a 60-minute limit per meeting and allows up to 100 participants to join a call. It works in conjunction with other Google services. *Google Meet* uses several security measures like multiple-step verification and unique encryption keys.
3. Invoice and accounting software *FreshBooks* is easy-to-use double-entry accounting software that supports accounting features like invoicing, estimates, reports, and expenses and extra features like time tracking and project management.
4. *Freshdesk* is essential on a website if a business is trying to sell a product or service. It can create a knowledge base and forums so that customers can help themselves before writing to customer service. It unifies all support-related communications on a single platform.
5. *Google Analytics* tools allow operators to analyze all necessary data in a single management decision-making interface. With this tool, it is possible to analyze sales, conversions, actions of users on the site, users' transitions, and more. *Google Analyst* provides machine learning to teach the amateur user how to operate the data more efficiently and is compatible with other Google services.
6. *Google Drive* is Google's cloud storage platform featuring Google Docs and Sheets, which is a great office tool that makes file creation, sharing, and collaboration in real-time possible from across the world.
7. *MailChimp* helps businesses engage users with tailored emails received at the right time. It is easy to use, and very adaptable.
8. With features such as a business profile, catalog to show your products and services, auto messaging, QR codes to invite new customers, and other features, *Whatsapp business* allows businesses to enhance operations and provide them with a professional and personalized way to engage with their customers.
9. *Sage* business cloud accounting platform is a truly transformative digital tool for any business that has adopted it. The software comes fully fitted with advanced inventory, stock management, invoicing, debtor management, etc., and can be used across all industries.
10. The *Google Workplace* is a powerful digital transformation tool with a collaborative suite that includes Gmail, Calendar, Docs, Slides, My Tasks, Drive, and several others that employees can use to share real-time information.
11. *TalentSoft* is a cloud-based human resource software that enables human resource managers to have better interactions with other managers across the organization as well as employees. The tool has a wide range of features that cater to different human resource functions like recruiting, employee engagement, onboarding, etc.
12. *PayFit* completely takes away the hassle of manually preparing and processing payment of employee salaries and entitlements from human resources managers by automating the process using various features like an employee portal, onboarding and reporting, and exports.

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THEORETICAL PERSPECTIVES

Various theoretical viewpoints underpin the understanding of information technology (IT) adoption behavior in either big or small organizations.

Different theories are applied by several authors to capture the context of digital transformation. The technology acceptance model, the technology, organization, and environment model, and the united theory of acceptance and use of technology framework are a few examples (Oliveira & Martins, 2011; Van Dyk & Van Belle, 2019).

TAM proposes perceived usefulness (PU) and perceived ease of use (PEOU) as the central elements of IT adoption. An individual's intention to use an application is explained and predicted by his or her perception of the technology's usefulness and its simplicity. TAM provides the basis for unveiling the impacts of external variables on adoption decisions. Unfortunately, the model provides less meaningful information on users' opinions about adopting specific systems by having a very limited number of constructs.

TOE assumes a generic set of factors to predict the likelihood of technology adoption. The theory suggests that adoption is influenced by technology development, organizational conditions, business and organizational reconfiguration, and industry environment, and has been used to propose a perception-based model for electronic data interchange among small businesses. The factors of the adopted model have been found to significantly affect the ability of small businesses to digitalize their business process or activities (Alraja, Hussein & Ahmed, 2021). The technological context of the theory describes how adoption depends on the pool of technologies inside and outside the firm as well as the application's perceived values. Organizational context captures the firm's business scope, top management support, organizational culture, and complexity of managerial structure. Environmental context relates to enabling and hindering factors such as competitive pressure, trading partners' readiness, socio-cultural issues, government encouragement, and technology support infrastructures in areas of operations. Unfortunately, some of the constructs in the adoption predictors are assumed to apply more to large organizations.

The UTAUT framework categorizes and analyses the human factors involved in the adoption of new information systems. This framework was developed from a synthesis of the TAM framework and includes an analysis of the role of cultural issues in the adoption of new technology, and the framework has the objective of identifying and understanding the drivers of new technology acceptance and the likelihood of successful deployment. It identified four main drivers of user acceptance and usage behavior: performance expectancy, effort expectancy, social influence, and facilitating conditions, and has been used to explain the adoption of IT in business management. The model is however not suitable for explaining complex technology adoption decisions, where other factors like senior management commitment influence the decision to adopt.

Other frequently encountered underpinning perspectives are the alignment view, configuration theory, resource-based view, dynamic capabilities, organizational learning theory, the theory of organizations, network view, or business process reengineering. Theory of Reasoned Action (TRA), Theory of Planned Behavior (TPB), Innovation Diffusion Theory (IDT), etc.

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SOLUTIONS AND RECOMMENDATIONS

Based on the synthesis of the literature on the subject matter, the challenges faced by small businesses in the digital age are not insurmountable, so long as managers view the problems as that of strategy rather than being that of technology. It is therefore recommended that more attention be paid to those strategies that work well for small businesses. Although the underpinning theories and perspective are adequate, they are relevant mainly to large organizations. The overall downward-pointing cost of digital technology and the availability of a myriad of digital tools is a welcome opportunity for adoption, however, the capacity of the owner/manager of small businesses has to be scaled up. Third-party intervention is suggested. Recent studies show that small businesses are increasingly making inroads in the adoption of digital technologies, but the transformation process has been sluggish. The subsisting theories are not adequate and not specific to fit small business management; therefore, tailor-made digital technology adoption theories are required. More studies, specifically longitudinal studies, are required to appreciate the complexity of the problem and where intervention is required.

FUTURE RESEARCH DIRECTIONS

The fast speed of digital technological change is unprecedented and is set to quicken even faster in the future. Thus, managers must acknowledge this fact and therefore anticipate the next direction by constant environmental scanning, and at the same time adopt strategies to take full advantage of what is on offer. It is expected that future devices will be smaller, smarter, and interconnected. Stakeholders will have to respond to these changes. Digital transformation, as a management tool, will play an even more prominent role in business management in the future. Managers will therefore have to develop the willingness and ability to use the available resources to outperform competitors. The onus is then on researchers to develop viable models and provide an executable framework for implementation by small businesses. Resources will continue to be scarce in the future. Thus, equitable utilization of available resources should be the watchword, which also dovetails into the leadership challenge small businesses face in dealing with change. Scholars will have to iterate various versions of digital transformation models with the expectation of attaining an optimal solution for implementation.

CONCLUSION

As a management tool, digital transformation is a process that has responded to the changing and challenging business environments, such as the episode of the COVID-19 pandemic, and its implementation requires a clear strategy. For managers of larger organizations, the existing digital tools are handy and already custom-made for immediate deployment, thus mitigating the adverse effects of changes in the external environment. The small business manager is not that fortunate and therefore lagged with the appropriate response to disruptions, such as the pandemic. The aforementioned is however not the whole story, because the same pandemic experience brought to the fore the dexterity of small businesses to face new challenges. Many did deploy ingenious solutions to their problems with their limited access to digital tools.

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Digital transformation is a pillar to the success of many large companies, but until recently, has had limited success with small businesses. Thus, scholars and practitioners are waking to the realization that the sector requires urgent upliftment to fulfill its enviable role in local and global economies. New theories and models are being developed to accommodate the noticeable gap in the deployment of digital technologies in small business management, and recent studies are lending credence to the capacities of small businesses to adopt these technologies and adapt to the changing environments.

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KEY TERMS AND DEFINITIONS

Digital Technologies: These are electronic tools and devices that generate, store, and process data.

Digital Tools: These are online platforms or software applications used to perform quick and optimized functions, and make tasks easier.

Digital Transformation: The gradual shift from the use of analog technology for organizational operations to the use of information and communication technologies.

Management: The process of effective and efficient acquisition and utilization of resources for the benefit of an organization.

Management Tools: These are instruments that support the implementation of concepts and ideas at all levels of management, to support the entire organizational process.

Small Business: A business organization that employs less than 50 staff and with limited capital and technical expertise.

Strategy: The deliberate long-term plan of action of managers to outwit competition under different circumstances.

Theories: The carefully thought-out explanation for observations of the natural world using the scientific method.

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Chapter 20
Conceptual Review of Technology Enabled Marketing

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ABSTRACT

Technology is changing rapidly, which is constantly changing the status quo in people's lives. It is difficult for marketers to understand these accelerating changes and act on them. In this work, the author explores how the marketing discipline has evolved due to changing technologies over the years. The work first uncovers the major changes in technology and ponder the foundational concepts which have led to these technology changes. Then it reflects on these changes from a marketing lens and understand how the new concepts have emerged in the discipline. Further, the author dives into how the changes in marketing discipline have impacted consumer behavior and subsequently predict the directions in which the marketing discipline would evolve due to changes in technology. The contribution of this paper is a comprehensive literature review and development of a framework that links the changes in technology and resultant changes in consumer behavior which throws up new research agenda in technology-enabled marketing for academicians and Ph.D. scholars working in this area.

INTRODUCTION

Technology is touching human life unprecedentedly, providing hitherto impossible opportunities, like assisted driving, mobile ticketing, environmental monitoring, augmented maps, domotics, etc. (Atzori, Iera, and Morabito, 2010). We are in a world of ubiquitous digital platforms with amplified networks, cloud computing, billions of intelligent end-user devices, and an abundance of data, information, and knowledge (Bharadwaj et al., 2013). This is being further augmented by the growth of the Internet of Things (IoT) (OECD 2012). IoT is a promising paradigm where many of the objects that surround us shall have a pervasive presence, and they will be on the network in one form or another (Gubbi et al., 2013). The internet has changed drastically the way we live, moving interactions between people to a virtual

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level (Pew Research Center, 2018). The COVID-19 pandemic has accelerated the uptake of digital and cloud technology in every business function.

According to the Oxford dictionary, digital means data involving or relating to the use of computer technology. Digital is any technology that connects people and machines or with information (King, 2013). But when we say everyone is 'going digital', there is a transformation of structures caused by digital technologies. Traces of modification of systems can be witnessed in changing social media landscape. Word of mouth has gained significance like never before with increasing social networking websites (Wardynski, 2019). Mobile devices offer ubiquitous connectivity and access to information which allowed consumers to create content and amplify their voices (Labreqcue et al., 2013).

Technologies have driven out latency as consumers know product availability and prices through smartphones and mobile apps (Hendrix 2014). Armed with digital technologies such as Fitbit, individuals capture, track, and use data about themselves to improve their health in a better way (Kelly, 2011). Big data is a new axiom, as capturing and using digital traces has led to explosive data which companies can harness to survive and gain an edge (Huang, 2018). This acceleration of technology change has influenced the marketing paradigm also.

Marketers have always been keen early adopters of any new tech trend to map the changes– from big data analytics to social media and artificial intelligence (AI). Marketing, as a domain, deals with changing behavior. Hence to appreciate the marketing discipline, one needs to understand the behavioral changes due to digitization, create more consumer value and explore new marketing avenues. Sheth and Solomon (2014, p.123) proposed that *"in today's digital world, the environment adapts to the self, as much, if not more, than the self-adapts to the environment."* This paper aims to find how these technological changes have affected the marketing discipline and thus changed consumer behavior. And what are the future trends in technology that can affect the marketing discipline.

Thus in the first section, we map the significant technological changes which have enabled the marketing-related changes. The second section understands how marketing concepts have evolved due to technological change. In the third section, we map the behavioral changes in consumers enabled by technology. In the fourth section, we map future trends, and finally, we conclude with a research agenda that needs to be reckoned with.

SECTION 1: MAPPING THE CHANGES IN DIGITAL TECHNOLOGY

Brian Winston (1995, pg,.55), in his book, distinguishes between 'change' due to technology determinism and cultural determinism. Technology determinism is where technology is dominant, determining factor that can be isolated and traced as the driver behind the change (Winston, 1995). In cultural determinism, social and economic factors either support or block technology innovation in the course of events; technology is clearly just part of a solution and not a driver of change (Winston, 1995). Thus, keeping this perspective in mind, it is essential to map the trends to identify the role of technology as a driver or enabler in evolving and reshaping the environment.

The advent of the technology change can be dated back to the dawn of the industrial revolution when the mechanics of the hand-operated Gutenberg style press were changed with the introduction of the first industrial printing press by 'The Times' in London in 1814 (Branson, 2012). This led to the starting point for nearly two centuries of relentless progress and innovation in communications media. There are some critical milestones in the interim period where new technologies can be seen to fundamentally

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change the communications and behavioral ecosystem. On a global scale, these might include the advent of radio in 1922, a television in 1941, and the launch of the first satellites into space in 1957, then, from the 1980s to date – the introduction of the fast-pervading worldwide web (Branson, 2012).

Modern information technology began with the invention of the transistor in 1947, a semiconductor device that acts as an electrical switch and encodes information in binary form (Jorgenson, 2001). After which, Kilby and Noyce (1959) co-invented the integrated circuit. It consists of millions of transistors that store and manipulate data in binary form. Integrated circuits were initially developed for data storage and retrieval. And semiconductor storage devices became known as memory chips (Jorgenson, 2001, p.2).

The changes in IT infrastructure ranging from developments in computer processing, memory chips, storage devices, networking hardware, and software design can be devoted to few key developments. These significant changes have been at the core of technology-enabled marketing as they have exponentially increased computing power while reducing the cost. The first is Moore's law. Gordon Moore, around 1970, illustrated that the number of transistors per square inch on integrated circuits has doubled every 24 months since their invention, which was later modified to 18 months (Tuomi, 2002). The law was interpreted in three ways: first- The power of a microprocessor doubles every 18 months, second, computing power doubles every 18 months and third, the price of computing falls by half every 18 months (Tuomi, 2002). The growth in chip complexity and fast reduction in manufacturing costs made increasing speed and decreasing cost essential element of today's technological advancement (Tuomi, 2002). Another aspect equally essential is increasing storage, supported by the 'Law of mass digital storage', which states that the amount of digital information is roughly doubling every year, and the cost of storing digital information is falling at an exponential rate (Lyman and Varian, 2003).

Corollary to Moore's law is Bell's Law of computer class which defines the state of miniaturization in technology. He states that roughly every decade, a new, lower-priced computer class forms based on a new programming platform, network, and interface resulting in further usage and the establishment of a new industry (Bell, 2007). Starting from mainframes (the 1960s) to minicomputers (1970s), followed by then personal computers and workstations with a network enabled by Local Area Networking or Ethernet (1980s), technology has advanced. Then came web browser client-server structures enabled by the Internet (the 1990s), handheld devices from media players and cell phones to tablets (2000-2010), cloud computing (2012), and now the wireless sensor networks that enable sensor and actuator interconnection, enabling the Internet of Things (Bell, 2007). Thus, changes enabled by smaller size devices (miniaturization) form another significant technology driver in this evolution. Moore's law and the law of mass digital storage helped us understand why computing resources are now so readily available. However, there is still a question, why do people want more computing and storage power.

Robert Metcalfe- the inventor of Ethernet local area network technology, claimed that 'as the number of members in a network grows linearly, the value of the entire system grows exponentially and theoretically continues to grow forever as members increase' (Hendler and Golbeck, 2008). Metcalfe's law has been used to explain the growth of many technologies ranging from phones, cell phones, and faxes to web applications and social networks, especially online social networks (Hendler and Golbeck, 2008). The network effect holds as the number of people in the network grows, the connectivity increases, and if people can link to each other's content, the value grows enormously. This marked the beginning of the Web 2.0 era.

In the recent past, the Web has been transformed from being a medium in which information is transmitted and consumed to a platform where content is created, shared, altered, and reproduced (Chatti et al., 2008). Tim O'Reilly (creator of the World Wide Web) stresses network effects stem from the

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participation of many humans and collective intelligence, which forms essential features of Web 2.0 (as cited in Fuchs et al. 2010). In contrast to web1.0 where people were passive viewers of content, Web 2.0 allows users to interact and collaborate in a social media dialogue as creators of user-generated content in a virtual community (Dwivedi et al., 2011). O'Reilly (2005) mentions the following attributes as the main characteristics of Web 2.0: radical decentralization, radical trust, participation instead of publishing, users as contributors, rich user experience, collective intelligence, and better software by more users. The defining aspect of a successful Web 2.0 application is sharing content and interaction via social networking. Going by the trend of constant evolution, the Web is now slowly but surely transiting to a more data-centric phase in the context of Web version 3.0 (Motta & Sabou, 2006, cited in Dwivedi et al., 2011)

From a technological viewpoint, Web 3.0 is an amalgamation of Web technology and Knowledge Representation (KR), which is a substructure of artificial intelligence (AI) (Firat, & Firat, 2020). Web 3.0 can be viewed as "semantic web technology integrated into or powering, large-scale applications" (Hendler, 2009, p. 111), developed using networked digital technologies that support human cooperation (Fuchs et al., 2010). The new conception is essential as it makes information more meaningful to people by making it more understandable to machines (Feigenbaum et al., 2007). With its semantic nature, Web 3.0 makes the web even more interactive, whereby intelligent machines can read, understand, interrelate, and manipulate data from cyberspace (Cabada et al., 2018; Garrigos et al., 2012). In addition, the new technology allows listening, learning, and cooperation, so that each customer or stakeholder can be treated differently (Garrigos-Simon, Alcamí, and Ribera, 2012), making personalization possible.

Technology as a digital platform has been an enabler in today's changing ecosystem, with few elements driving technology-enabled marketing. The elements are increasing speed, reducing cost, increasing storage, network effects, and miniaturization. These changes have been responsible for various phases of the web. Fuchs et al. (2010), in their work, summarises. Web 1.0 technologies enable *cognitive processes of communication*, which are made possible through the individual's relationship with the hypertext. Web 2.0 technologies create the basis for the development of *communicative processes*, which are guaranteed by interactive platforms (e.g., social media), and Web 3.0 technologies facilitate *cooperative processes* that are integrative in the construction of new information and meaning (Fuchs et al., 2010).

Digital initiatives have revolutionized marketing, changing how companies reach and engage with customers. The next section highlights how above mentioned digital technological progress enabled the evolution of new marketing concepts.

SECTION 2: EVOLUTION OF MARKETING CONCEPTS DUE TO TECHNOLOGICAL ADVANCEMENT

Traditional marketing tactics and channels are being banished by digital schemes that are faster, more intuitive, and more relevant to the customer. Consumers purchase through a range of distribution channels and access the wealth of information available at their fingertips (Marrison, 2015). In the era of digital marketing management, where consumers feel more empowered with unprecedented access to information, social networks, and choice, the quest is to understand 'Are these technologies fundamentally changing human behavior or incrementally adding value?' To answer this question, we shall look at several marketing concepts that have evolved due to technological change.

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User-generated Content

Companies have traditionally been considered the sole creators of marketing messages to influence consumer behavior (Hautz, Füller, Hutter, and Thürridl, 2014). With the Web's transition into a participative environment (Web 2.0), consumers have gained influence and credibility as content creators in their own right (Liu-Thompkins and Rogerson, 2012). They have been bestowed with information-based power to consume and produce content (Labrecque et al., 2013). As content consumers, they have easy access to product reviews and comparative product specifications, enabling consumers to make better choices and match their preferences. As content producers, they can now contribute online in various ways, in blogs, podcasts, videos, online social networks, games, and user reviews. Now consumers have the possibility of broadcasting which they did not have earlier but counterintuitively, marketers not only have broadcasting, but they also have the option of tracking every move of the customer through analytics, thus shifting the balance of power back to the marketer. Thus making user-generated content a significant marketing concept evolved due to technology. Also, the level of trust varies across user and firm-generated content, which needs to be monitored in future studies across various media.

Interactivity

The network effect given by Metcalfe elucidates the growth of various web applications and online social networks (Hendler and Golbeck, 2008). Networked digital technology enables consumers to connect more readily through email, web-based social networking platforms (Facebook, Linkedin, etc.), or mobile messaging (Whatsapp, Viber, etc.). Niche aggregation is growing with like-minded individuals congregating online in the form of virtual communities (Seraj, 2012). Web 2.0 technologies and the rise of social media have enabled widespread network-based power (Labrecque et al., 2013).

Constantinides (2014) proposes two approaches to using social media (SM); the first is passive approach, which focuses on utilizing the SM domain as a source of customer's voice and market intelligence. Second, is the active approach which involves engaging social media as channels of customer influence and direct marketing. Network effects enable applications like Blogs, Social Networks, Content Communities, Forums/ Bulletin Boards, and Content Aggregators (Constantinides, 2014). This helps in mapping customer insights, including how consumers are interacting with each other and the products and services they consume (Leeflang, Verhoef, Dahlström, and Freundt, 2014). This change in the magnitude of interactivity, openness, and participation enabled by technology has benefitted consumers and marketers. Consumers are more likely to get products and services according to their expectations. For marketers, social media can be advocated as a medium of customer engagement and value creation.

This increasing interactivity and openness have changed the marketing paradigm. However, marketers must acknowledge that people experience the social obligations of maintaining active profiles due to social networking. This may lead to discontentment and privacy risks (Markos, Labrecque, and Milne, 2012). People affect one another through complex social/interpersonal influences, which are conscious or unconscious, normative, or informative (Eck van, Jager, & Leeflang, 2011). The need for being socially accepted is increasing, thus questioning if social normative influence dominates the existence of personhood? The speed of social media penetration into human lives and their indispensability may lead to entrapment. Business leaders need to understand that technology needs to come with consciousness, not compulsiveness.

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Sharing

Another change in the marketing world that is owed to the web 2.0 phase is the concept of sharing than ownership. Sharing as a phenomenon is as old as humankind, while collaborative consumption and the sharing economy are phenomena born of the Internet age (Belk, 2014). "Instead of buying and owning things, consumers want access to goods and prefer to pay for the experience of temporarily accessing them" (Lamberton and Rose, 2012, p. 881). With the rise of sharing economy, businesses like Zipcar, Kindle, and iTunes moved customers away from physical ownership to sharing. Organizations like Airbnb and Uber encouraged people to share excess capacity with other consumers. There are two commonalities in these sharing and collaborative consumption practices: 1) the use of temporary access non-ownership models of utilizing consumer goods and services and 2) reliance on the Internet, especially Web 2.0, to bring this about (Belk, 2014).

Marketers must focus their attention on how sharing as a concept in the digital age influences changes in consumer behavior. They must understand how culture and reference groups influence the sharing economy's based business models. Also, more digitization has led to a shift towards a more savvy and demanding consumer who wants to stay in control of their digital persona and how their personal information is used (Lamberton and Rose, 2012). Marketing leaders need to balance the trade-offs between privacy and personalization.

Ubiquity

Digital technology transcends the geographical boundaries and time zones to connect to a much wider audience (Dholakia and Dholakia, 2004). With the penetration of technology into and ubiquity, consumers can satisfy their needs more quickly and more efficiently with fewer barriers. Technology has transformed the world into instant gratification. This ubiquity of technology has mainly been accelerated due to mobile devices, especially smartphones, since 2007 (with the launch of the iPhone). Marketers have to embrace this immediacy to be ahead in the technology game. The increased capabilities of smartphones have presented marketers with more possibilities to get connected with customers not only by using rich media like text, audio, and video but also through a variety of apps, location-based services, gaming, or augmented reality which are all pull-based (Persaud and Azhar, 2012).

Due to recent developments in mobile technology and increased penetration rates, the mobile channel has morphed into an ultimate marketing vehicle, which enables business entities to establish a pervasive electronic presence alongside their customers anytime, anywhere (Varnali and Toker, 2010). The real differentiation of mobile as a platform is the immediacy of having access to information and services enabled by GPS sensors and motion sensors (Shankar and Balasubramanian, 2009). Mobile has enabled contextual marketing where customers can receive messages when and where they want (Winer, 2009). Smartphones can also transform the consumers' shopping experiences with a substantially more significant level of convenience, flexibility, efficiency, and personalization (Persaud and Azhar, 2012).

Another aspect adding to ubiquity for users and enterprises is cloud computing. It is a model for enabling ubiquitous network access to a shared pool of computing and resources thereby achieving coherence and economies of scale (Marston, et al., 2011). Cloud stores and processes data in third-party data centers. It reduces the cost of storing and adds value (Taylor, 2015). Ubiquity has led to immediacy and removed latency, inadvertently making the consumer anxious and impatient.

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SECTION 3: CHANGES IN CONSUMER BEHAVIOR DUE TO THE EVOLUTION OF MARKETING CONCEPTS

Gord Hotchkiss (2010) illustrated that technology doesn't change behavior- technology enables behavior to change. Due to technology-enabled marketing, some of the changes in consumers' behavior are listed in the section below.

Fear of Missing Out (FOMO)

With changing pace of life, people are advantaged by a multitude of opportunities for interaction enabled by social media. And sometimes, people struggle with more options than can be pursued, given practical restrictions and limited time. This dual nature of social media has driven popular interest in the concept of Fear of Missing Out – popularly referred to as FOMO (Przybylski, Murayama, DeHaan, and Gladwell, 2013). This change in the behavior of consumer provides a salient example of how this trend fosters ambivalence about social media. FOMO is characterized by the desire to stay continually connected with what others are doing. It is defined as a pervasive apprehension that others might be having rewarding experiences from which one is absent (Przybylski *et al*., 2013, p. 1841). To overcome these, marketers should personalize their correspondence with customers, engage them with brands through participation and raise peer-to-peer (P2P) transactions.

Engagement with Brands

As life online and offline become increasingly intertwined, consumers have more interaction and participation, resulting in increased engagement with brands. Engagement behaviors go beyond transactions. "Customer engagement is defined as a customer's behavioral manifestations that have a brand or firm focus, beyond purchase, resulting from motivational drivers" (Doorn et al., 2010, p.254). Behavior such as participation in brand communities, blogging, online discussions, commenting, information search, and voluntarily suggesting design improvements in a product are the recent changes owing to the Web 2.0 era.

The scope of engagement has increased with user-generated content (Gummerus, Liljander, Weman, and Pihlström, 2012). Users can have low levels of engagement by passively consuming content or giving feedback (e.g., "liking" a page on Facebook). They can also have higher engagement, whereby consumers participate in co-creation, such as writing reviews or creating videos showcasing the product (Malthouse et al., 2013). It is essential nowadays for brands and companies to be socially active. Marketers should engage customers more visually than text-based as it is a more appealing factor for millennial customers. Engagement has become a precursor of loyalty, but the question is if it is a higher-order objective than customer loyalty in the digital era.

Co-creation

With the development of highly interactive platforms, customers have transformed from passive clients into active ones. Online consumers are increasingly involved in creating the products and services they purchase (Ryan, 2014). Customer co-creation is an active, creative and social process, based on collaboration between producers (retailers) and users, that is initiated by the firm to generate value for customers

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(Piller, Ihl &Vossen, 2010). Co-creation means the contributions made by customers that assist a firm in designing and developing of its new product offerings (Prahalad & Ramaswamy, 2004).

O'hern and Rindfleisch (2010) classified four emerging forms of co-creation: (1) Collaborating, (2), Tinkering, (3) Co-designing, and (4) Submitting. These are delineated by the degree to which customers are empowered to contribute (fixed by a firm to wholly open customer input) and the selection of new product ideas (directed by a firm or directed by customers). It is important to note that mass customization is not a form of co-creation as it does not incorporate customer input into the actual creative process (e.g., Jeppesen and Molin 2004; von Hippel 2005). But it is essential to analyze if co-creation enhances loyalty or does it lead to advocacy due to temporary involvement.

Closely related to the concept of co-creation is crowd-sourcing. It means outsourcing an activity to a large and undefined group of people, a crowd (Pénin and Helmchen, 2011). Crowdsourcing is necessarily initiated and managed by an organization, either private or public (Pénin and Helmchen, 2011). The main distinction between crowdsourcing and co-creation is that crowdsourcing represents reach in terms of accessing a broad spectrum of people and ideas. In contrast, co-creation represents reach, richness, and depth (Roth, 2012). The question to rethink is if crowdsourcing is a toolkit for corporate innovation?

Seek the Opinion of Others

The collective intelligence of online review sites and social media has allowed consumers to get a second opinion. But with changing digital paradigm, consumers progressively seek the opinions of peers and strangers alike. This behavioral change in consumers is to validate their choices and avoid feelings of buyer's remorse. Consumers actively look out for others' view,s from eating out to purchasing big-ticket iite.ms For some products, categories reading reviews and seeking opinions is the first step in the purchasing process, especially in areas that lack expertise. There have been studies in the literature that point out how the opinion of others influences purchase decisions (Cabezudo, Izquierdo, and Pinto, 2013). Marketers need to pay more attention to the review and rating sites and concentrate on the phenomenon of e-WOM. It is essential to understand that Word of Mouth (WOM) in an offline environment is verbal, whereas, in the case of online, it is written, which means that consumers are putting in more time, effort, and thought while scripting the same. Thus, it is essential to analyze how WOM is different from e-WOM.

Variety Seeking

Due to deflation in the cost of connectivity, hardware, and software, and high internet penetration, consumers can compare products even more quickly, read reviews and switch if the competitor's product is desirable or if they are getting better offers. Variety seeking refers to a "phenomenon that consumers engage in varied behaviors, such as brand switching or multi-brand buying" (McAlister and Pessemier, 1982, P.3190). It is invasive because of the tendency of individuals to seek diversity in their choice of search and experience goods (McAlister and Pessemier, 1982; Ratner, Kahn, and Kahneman, 1999). Even if the customer is delighted with the usage of current products, the customer desires to try other competitors' products and therefore switches to other brands (Wang and Goh, 2012). Due to technology-enabled changes, variety-seeking behavior has increased compared to the past. This phenomenon is making marketers' jobs very complicated. This area needs an in-depth understanding as e-customers switch quickly, thus making it challenging for marketers to hold them. An understanding of variety-seeking behaviour in digital good purchases will provide important insights for producers, retailers, and marketers.

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Information Seeking

Internet penetration, an open-source economy, and the proliferation of search algorithms have generated unprecedented information. Information-seeking behavior actively seeks information to answer a specific query (Wilson, 2000). In this digital age, consumers continuously seek information from numerous resources available at their end. Indeed, information thinking skills are not unique to the digital era; they were always crucial traits (Wilton and Meyers, 1986). However, in the digital age, with the unlimited exposure of humans to digital information, these skills have become fundamental survival skills; they enable learners to make educated uses of information (Eshet, 2012). Unfortunately, most studies of digital information skills focus on the information search strategies and habits of users (e.g., Bus and Neuman, 2009; Morahan-Martin & Anderson, 2000), and only a few stress the cognitive and pedagogical aspects that are relevant to these skills (e.g., Burnett & McKinley, 1998; Minkel, 2000; O'Sullivan, 2000).

Also, it has been found that millennials are not influenced by advertising and believe in reviewing blogs or social media before making a purchase (Dominick, 2010). The exponential growth in the amount of available information, side-by-side with the proliferation of social networks, blogs, podcasts, wikis, and file-sharing technologies, led to information overload, also known as infobesity (Bain, 2013). Information overload leads to confusion and sub-optimal choices in decision-making (Botti and Iyengar, 2006). Marketers need to respond to this information overload phenomenon by filtering and personalizing information for their customers.

Showrooming

Due to the channel multiplicity effect (Van Bruggen et al., 2010), customers are now indulging in research shopping (Verhoef, Neslin, and Vroomen, 2007) or seeking information in one channel (e.g., online; catalog) and purchasing in another (e.g., retail store; wholesale outlet). This manifestation has been termed showrooming (Clifford, 2012, as cited in Rap et al., 2015). This behavior is motivated by consumers' desire to get the best deal (Evans 2012). Consumers have always been driven by value-seeking and reference prices (Kalyanaram and Winer 1995). However, technology has increased market transparency enabling consumers to go into a store, interact with products, and then immediately go online to determine whether a better deal is available elsewhere and, if so, to purchase the product in real-time (Cruz and McKenna 2011). Consumers, after viewing products, may buy at the retailer's online site, but they mainly purchase at sites offering better deals (Rapp et al.,2015). Retailers have been left without a clear understanding of managing this change in the retailing landscape, which needs academic attention.

Value authenticity

Consumers nowadays value authenticity and want transparency from brands and marketers (Yenicioglu and Christodoulides, 2014). Consumers process and make decisions profoundly as information can now be obtained, uploaded, and disseminated within seconds. The Digital era has made consumers aware and better informed (Lantos, 2014). They are conscious, ethical, and mindful that a company should give back to society instead of just making a profit (Lantos, 2014). Millennials endow brands that support their local communities and would rather give more preference to them than competitors. It is essential to analyze the role of digital authenticity in a time of interactivity, openness, and collaboration. Consumers demand a more open and honest relationship with big brands based on mutual respect and integrity

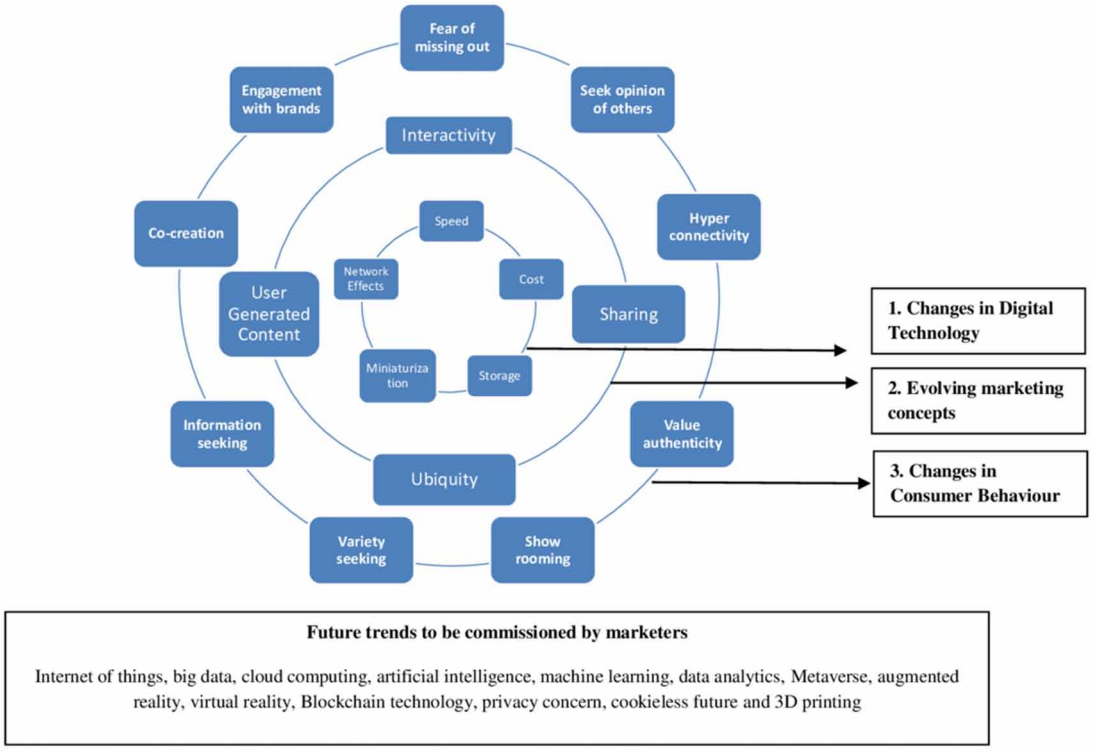
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(Yenicioglu and Christodoulides, 2014). The marketer needs to understand that trust is essential for consideration in purchases across any digital medium. In the digital age, the chances of brands being caught concealing important information are much higher. Consumers' evaluation of digital authenticity for brands needs research attention.

Hyper-connectivity

Hyper-connectivity refers to the simultaneous use of multiple means of communication, such as email, instant messaging, mobile, and Web 2.0 information services (Quan-Haase and Wellman, 2006). With hyper-connectivity, telecommunication technologies can connect people more rapidly and efficiently than in the past, overcoming temporal and spatial boundaries (Amer et al., 2014). In today's uber-digital marketplace, these changes have given marketers a new opportunity by providing seemingly countless touchpoints between buyers and businesses, from social media to mobile to email. Hyperconnectivity is also providing hyper-efficiency among consumers. Customers want products to interact with them through as many senses as possible. They crave interaction and active participation. The challenge for marketers is meeting soaring customer expectations for sophisticated and personalized experiences (Casagrande, 2014). But with wearable devices, smartphones, tablets, smart TVs, and all the other advanced devices fighting for our attention every minute, people are starting to feel ambivalence toward the digital realm. There will be a problem of touchpoint proliferation.

Figure 1. Technology Enabled Marketing



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SECTION 4: FUTURE TRENDS

The COVID times have taught us that technology and society evolve faster than an organization can adapt. This phenomenon of Digital Darwinism brings a challenge for businesses to compete for today and the unforeseeable future. In the phase of Web 3.0, technological changes pivot around accurate interpretation and personalization in a smart human-like way through technologies like machine learning (ML), Big Data, decentralized ledger technology (DLT), etc. Some of the new trends this semantic web offers are the Internet of Behavior (IoB), artificial intelligence, machine learning, data analytics, augmented reality, virtual reality and metaverse, blockchain, cookieless future, and more (Dey, Saha, Singh, & McDonald-Maier, 2022). Meeting the changing expectations of consumers and anticipating the undefined demand of tomorrow requires marketers to understand these changes in technology. These trends need to be embraced by marketers and leaders of tomorrow as they will act as enablers for the next generation.

Web 3.0, the third generation internet, is a secured semantic web; based on the premise that 'no single entity can own your data.' It is being built on blockchain technology, which helps provide asset ownership on the base of digital records, which are unique and independent of involvement from any central entity (Meiriño, et al., 2019). Blockchain technology as an electronic distributed ledger, offers novel opportunities for marketers to use cryptocurrency, and non-fungible tokens (NFTs) to reach their audience, drive awareness, and even promote new product lines (Melkić, & Čavlek, 2020).

Another significant trend that aims to redefine the marketing paradigm is the Internet of Behavior (IoB) which combines the Internet of Things (IoT) with data analytics and behavioral science. IoT offers new waves of productivity, growth, and innovation. Previously unconnected objects can now be accessed digitally and controlled from anywhere on various devices, including mobile, desktop, and tablets (Gubbi, Buyya, Marusic, and Palaniswami, 2013). The adoption of these smart devices requires marketers' attention. The multiplicity of devices generates big data, which is then stored in the cloud (Wazid, et al., 2019). Increasing machine-to-machine interactions will change the role of customers and provide a vast amount of information for marketers. Thus marketers will require sophisticated analytics to find insights from these large datasets and create dashboards thereafter.

Also, the growth in natural language processing (NLP) solutions will enable AI tools to progressively deliver a complete holistic customer view that marketers have long strived for in an automated and targeted fashion. As the machine learns over time, conversational and voice bots will become more cultured and continue to service customers and provide solutions when interacting with potential customers (Milne-Ives, 2020).

Another buzz trend that is claiming to change marketing function is the metaverse (Sparkes, 2021). It is futuristic blend of virtual reality (VR), augmented reality (AR), and artificial intelligence (AI). It means integrating the virtual world and the user's real-world in a way that they appear as one environment (Zhan, et al., 2020; Bronack, 2011; Klopfer& Squire, 2008). AR can be considered a central technology in this change for marketers as it offers virtual representations of real products, from clothing to home furnishing, in real-world environments making it a strong tool for many marketing strategies (Olsson, Kärkkäinen, Lagerstam, and Ventä-Olkkonen, 2012). Brands use this technology to culminate a new 3D immersive experience where users can create their avatars, and try on clothes, sit on chairs, live in certain geographical areas, and so forth (Rauschnabel, 2022). AR technologies also provide more immersive and experiential digital shopping experiences, proven to drive brand engagement and loyalty. Also, deploying extended reality as technology can offer the experience of hybrid events (Zhan, et al.,

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2020). This will allow audiences in a remote location to explore and interact with an event as if they were there on the ground or allow in-person attendees to engage with digital or virtual elements.

This customization due to digitization, which benefits consumers, also poses privacy hazards. Technology via different mediums has been embedded in everyday life. There's just a vague notion that there's less privacy than there used to be for most consumers (Maseeh, 2021). Consumers may not see the connections between the information sharing, the value they receive for it, and the inherent risks. This needs to be articulated (How much are consumers willing to give up privacy for the benefits?). With the growing concern about privacy and awareness amongst consumers, marketers will have to balance personalization and tracking behaviors (Jozani, 2020). Also, the support of third parties cookies will be withdrawn from many browsers. Thus, marketers should look for alternative mechanisms to track behaviors when the internet ecosystem goes cookieless (Thomas, 2021).

Another trend that asserts to disrupt the market is 3D printing (Shahrubudin, Lee, & Ramlan, 2019). Its extreme flexibility allows for easy customization of goods at relatively low costs and eliminates assembly and inventories (D'Aveni, 2015). 3-D printing has been valuable for producing prototypes and rare replacement parts such as dental crowns and artificial limbs (Berman, 2012). Companies need to reconfigure operations, given the myriad new options for fabricating products and parts.

Table 1. Future research agenda

Has the balance of power shifted towards consumers in the digital era? Or with analytics marketer has become even more powerful?
How does the level of trust vary across user-generated content and firm generate content in various media?
Are people facing discontentment and privacy risks due to social obligations of maintaining active profile on social networking platforms?
Is social normative influence (The need for being socially accepted) is dominating the existence of personhood?
How does culture and reference group influence the sharing habits of consumer in digital age?
How should the consumer make trade-offs between the perceived benefits of personalisation and perceived risk of privacy?
Has the balance of power shifted towards consumers in digital era? Or with analytics marketer has become even more powerful?
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Is social normative influence (The need for being socially accepted) dominating the existence of personhood?
How does culture and reference group influence the sharing habits of the consumer in the digital age?
How should the consumer make trade-offs between the perceived benefits of personalization and the perceived risk of privacy?
Has the balance of power shifted towards consumers in the digital era? Or with analytics marketer has become even more powerful?
How does the level of trust vary across user generated content and firm generate content in various media?
Are people facing discontentment and privacy risks due to social obligations of maintaining active profile on social networking platforms?

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CONCLUSION

With technological advancement, the focus has been shifting toward openness, cooperation, and co-creation. Technology is enhancing traditional business models and creating new ones unprecedentedly. The article aimed to examine the significant changes in marketing and consumer behavior due to advancements in technology. In the sections above, we saw how technology has evolved over the years from web1.0, 2.0, and now web 3.0 eras. We initiated by mapping significant technology changes, namely increasing speed and storage, reduction in cost, miniaturization, and network effects. The following section configured the evolution of marketing concepts due to the technology change like interactivity, ubiquity, sharing, and user-generated content. Eventually, we listed the incremental changes in consumer behavior enabled by technology. Then ultimately we listed future trends in marketing that are significant for marketers in web 3.0 era.

Amidst all this, we try to project the likely changes in technology and predict the directions in which the marketing discipline would evolve. In past, digital was an add-on function in the marketing equation. Today, digital is at the core of everything we do in marketing. Smart companies are leveraging these technologies to gain mindshare and time-share of the tech-savvy customer. Enterprises must understand these technologies and focus on creating a holistic digital strategy. Too many companies think in terms of digital marketing. Instead, they should be thinking in terms of marketing in a digital world.

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Chapter 21
The Impact of Disruptive Digital Technologies on Organizational Structures and Marketing Systems:
Democratization of Marketing in the Solidarity Economy

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ABSTRACT

Disruptive digital technologies, such as Web 3.0 and 3D printing, have been instigating new organizational structures and by extension new marketing systems given that they change and evolve in response to technological and social changes. By capitalizing upon institutional theory, this chapter delineates how Web 3.0 technologies enable social change via global collaborative commons, which have the potential to ascertain distributive justice for public at large. It also prognosticates how the marketing discipline in Era V (2020-?) will have to go through a sea change to reproduce and carry itself to a further level if it does not want to face the risk of extinction.

INTRODUCTION

Disruptive digital technologies (DDTs), such as Web 3.0 and 3D printing have been instigating new organizational structures and by extension new marketing systems. The traditional marketing system under the influence of Dominant Social Paradigm (DSP) has been morphing into a "purposeful marketing system", which has been evoked by digital commons or Global Collaborative Commons (GCCs) in recent years. The tradition-shattering purposeful marketing system is a reciprocative one based on

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distributive justice, which rejects the pre-established and socially constructed structures and appears to complement tradition-bound regnant marketing system, if not to replace it.

Until the onset of the new millennium, traditional chain-and-command organizations (CCOs) have been operating in the context of tradition-bound marketing system or the "received marketing paradigm", which essentially prioritized growth, customer life-time value, targeting middle- and upper-class high value markets (Achrol & Kotler, 2012). The received marketing paradigm was also firm-centric and aimed to create value inside the business entity. Starting from 2007, these vertically integrated CCOs have adopted Web 2.0 technologies and incorporated users into their innovation and value creation activities in alignment with the new innovation paradigm, called open innovation (Chesbrough, 2003). This paradigm change has been evolutionary in its approach to value creation as it emphasized the importance of crowdsourcing and co-creation in innovating, devising, and developing creative products by drawing on external agents. Even though co-creation through Web 2.0 includes users in design and production, the process is orchestrated and controlled by the firm over a centralized platform through "value-in-access" perspective (Kelleci, 2021). This practice is a continuation of "marketing-as-usual" perspective (Sheth & Sisodia, 2006) and still entails a firm-centric approach to value creation. In firm-centric marketing-as-usual perspective, the goal is to increase sales and profitability largely on behalf of shareholders. Nevertheless, today, this approach has been shifting toward decentralized management approaches due to the advances in Web 3.0 technologies, the rise of participatory culture and, consequently, the emergence of Open Value Networks (OVNs) and Global Collaborative Commons (GCCs) respectively. These spawned organizational structures (i.e., OVNs and GCCs) stimulate a new marketing system, which capitalizes on a new type of value-creation, called "value-in-participation" (Kelleci, 2021).

Both OVNs and GCCs are rested on open-source movement. Nevertheless, there are a number of differences between them. By way of illustration, OVNs draw on Web 2.0 technologies, and they primarily enable intangible (or in some cases tangible) public resource sharing, resting largely on "value-in-possession" perspective (Richins, 1994). For instance, Open Motors, formerly known as OSVehicle, could be illustrated as an example of OVNs given that the company's purpose is to share intangible resources to democratize mobility. On the other hand, GCCs make use of Web 3.0 technologies and they seek to share revenue and distribute wealth on a fair basis. Web 3.0 is the underlying enabler of an emerging Global Collaborative Commons (GCC) movement by dint of Internet of Things (IoT) and Artificial Intelligence (AI) together with 3D Printing or additive manufacturing. IoT is a powerful twenty-first century intelligent network, which makes it ideal to reify "postcapitalist commoning", evoked by supra-individual digital collective intelligence (Peters & Reveley, 2015). This new organizational structure portends a paradigmatic form of nonmarket – social production in an emerging economic paradigm of twenty-first century, called solidarity economy. In this regard, GCCs are more revolutionary configurations as they rest on the emerging "value-in-participation" perspective, which aims to create distributed or inclusive value for society at large. (Kelleci, 2021, p. 4). Thus, GCCs appear to bring about shock and awe for traditional chain-and-command organizations (CCOs). For instance, Sensorica, which is conceived as GCC, could be illustrated as a paradigmatic form of social production. It aims to develop crowd-sourced hardware and software services (e.g., IoT, precision agriculture, renewable energy, scientific instruments), which is based on commons-based peer production (CBPP) movement (Wikipedia, 2021). Sensorica is not a corporation but could be defined as a non-registered association, which employs a value accounting system (VAS) to evaluate the contributions of Sensoricans (members of Sensorica) and to compute equity in the product, i.e., percentage of contribution (P2P Foundation, 2011). VAS as a new social contract, which ensures that contributors will have their fair share in the future as well. In other words,

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VAS ascertains that each participant member will be generating revenue for the lifetime of the product that s/he co-created. VAS, as an Enterprise Resource Planning (ERP) type of software, takes all types of value (e.g., tangible and intangible) into consideration.

According to Institutional Theory (Hoffman & Jennings, 2015), institutional changes manifest themselves successfully when conditions are ripe or favorable—such as the rising awareness of the masses in the wake of drastic income inequalities, limitations of the linear economy as well as the perpetual DDTs. With respect to income inequalities, society is craving for a massive social change. For example, as a consequence of 2008 financial crisis, people from all walks of life began to question the credibility of traditional CCOs as well as high-involvement-organizations (HIOs) as they exploited people and abused the explicit social contract to manage our lives. It is now evident that citizens no longer rely on formerly trusted institutions and discord has been getting more pronounced given that trust is wearing away in all respects (Rainie & Perrin, 2021). As regards to DDTs, Web 3.0 technologies will appear to engender novel ways of operating with higher degrees of decentralization than they have today. Furlonger and Uzureau (2019) noted that sometime after 2025, DDTs (e.g., IoT, AI, blockchain) will converge and precipitate the proliferation of decentralized self-sovereign identities (SSI) (e.g., GCCs).

Taken together, the proposed chapter aims to contribute to a deeper understanding of how DDTs have been transforming organizational structures and by extension new marketing systems given that they change and evolve in response to technological and social changes. Furthermore, the proposed chapter will clarify how Web 3.0 technologies can enable social change via GCCs, which have the potential to ascertain distributive justice for public at large. Lastly, in connection with these dramatic alterations, the proposed chapter will prognosticate how marketing discipline in Era V (2020 -?) will have to go through a sea change to reproduce and carry itself to a further level if it does not want to face the risk of extinction (Hunt, 2020).

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Section 4

Investigating the “How” in Digital Transformation

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Chapter 22
Infusing New Technologies and Luxury:
A Literature Review and Current Issues on Luxury Fashion, Food, and Tourism

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ABSTRACT

The technology integration of luxury is a promising business opportunity. New technologies such as the internet of things, smart objects, artificial intelligence, the pervasive digitization of business processes, together with the shift of several business activities online are enabling unprecedented opportunities for luxury marketers and managers. Through qualitative research designs, this chapter would systematize knowledge about this topic with the means of a literature review. An amount of 224 contributions published in the last two decades (2010-2020) have been examined. Findings show current issues and opportunities on four promising topics: luxury hospitality, luxury fashion, luxury tourism, and luxury foods. Opportunities for scholars, marketers, and managers are examined together with implications for consumers' behavior studies.

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INTRODUCTION

In twenty years, the luxury market has profoundly evolved. The few exclusive channels for customers changed into numerous and diversified to attract different consumers' categories, who are increasingly sophisticated (Coste-Manière et al., 2012). In 2018, there was growth in the luxury market, along with the beauty care market, estimated at €451 billion and is expected to grow by 5% annually by 2022. However, in 2019 there was a slowdown in the number of transactions in the luxury sector, which is around 80 million compared to 304 million in 2017, while the "beauty" industry is strongly growing with a trend that has increased from 31% to 43% in just one year. Over the 2015-2019 period, the Personal Luxury Goods market grew annually by 5.7%, while in 2020, due to the Covid-19 pandemic, the luxury sectors declined 70% in tourism and up to 45% in hospitality. However, in 2022 growth levels are expected to match pre-Covid levels in a two-year period, especially in sectors such as accessories-manufacturing, cosmetics, accessories-retail and furniture going to reverse the negative trend of the past two years (Gerosa, 2021). It is interesting to note that at a global level, estimates are more than positive, but when analyzing individual markets, the market of the BRICs countries is most flourishing and thriving, unlike the European, Japanese, or North American markets which, although with growing trends, are going slowly. Online shopping helped by allowing growth from 2017 to 2018 of 22%, while the weight of the younger generation influenced the increase in luxury sales with 100%, up from 85% in 2017. Thanks to the advent of the digital era, technology has helped the luxury market, especially in sectors such as hospitality, tourism and fashion that are green and environmentally sustainable. In fact, technology can contaminate luxury, making it more desirable to consumers and state-of-the-art for new generations: for example, think of smart objects in hotels, voice assistants in stores, smart technologies in museums, technological appliances in sports centers.

By considering these premises we would like to systematize the most relevant literature concerning luxury and technology, by means of a literature review, to answer the following research questions:

- **RQ1:** What are the essential topics dealt with in current literature concerning the technology influence in luxury markets?
- **RQ2:** What are the most promising current issues and strands of research, which require further investigation?

METHODOLOGY

To answer the research questions, we implemented a qualitative research design by the means of a literature review. Following Guido et al. (2018), and Sestino et al. (2018), we assessed our qualitative analysis to shed light on promising research topics and business opportunities together with relevant implications for marketers and managers, through six phases (see Figure 1).

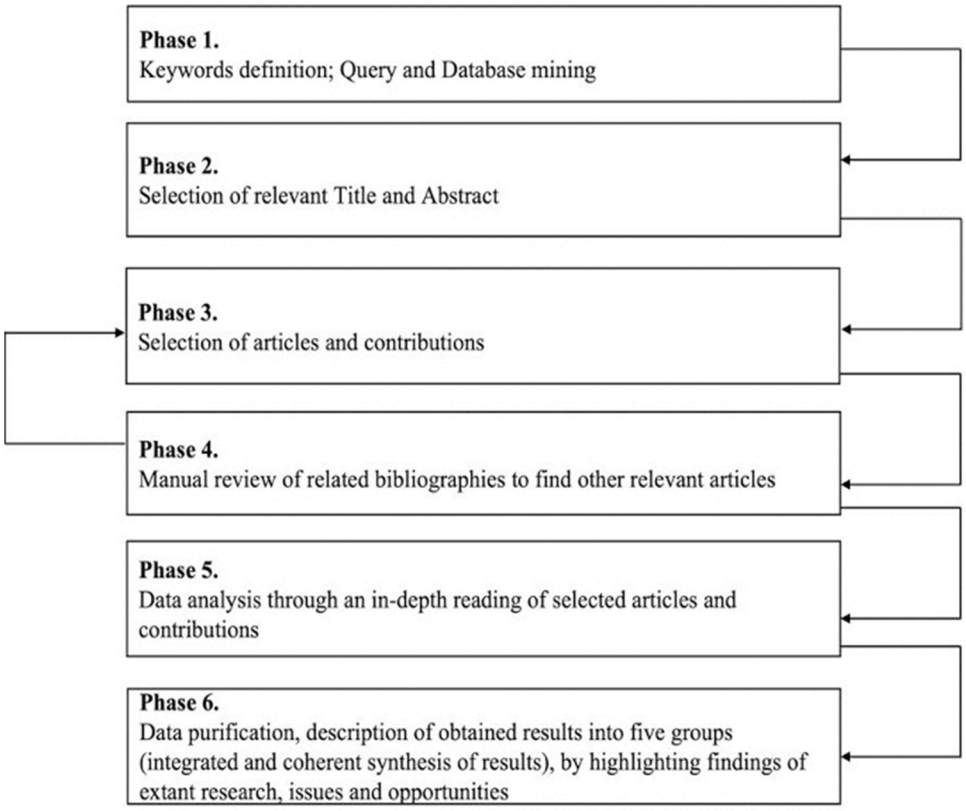
We firstly began our database mining by defining a list of 7 keywords and specifically "luxury", "marketing", "management", "digitalization", "technology", "new technologies" "business process re-engineering", as the most recurring in scholarly articles on luxury and technology research, published in the most important marketing and management journals. Once the keywords have been selected, we use these keywords and their combinations mining business databases (i.e., Google Scholar; Business Source Premiere and EconLit). However, to assess a complete review and include possible relevant contribu-

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tions (both theoretical and experimental studies), we also included further management and marketing journals covering the research areas related to luxury consumption and new technologies (e.g., as for retailing, communication, market research, services, engineering). We considered as a period the two last decades (2000-2010, and 2010-2020) because the most fruitful for technology research, together with some relevant contributions, appeared in 2021 to strengthen our framework.

We finally collected 352 original contributions. Then we read its title, and their abstract to verify the coherence with our chapter goal, focusing on 224 final original contributions (e.g., as for journal articles, conference proceedings, book chapters). Once the most relevant abstract has been selected, we deeply analyze the contents: More specifically, an in-depth data analysis based on the process of data extrapolation has been conducted, in the attempt to integrate the whole findings into a coherent manner (Bal and Nijkamp, 2001). The "reference industry" has been chosen as a criterion for grouping the results, also considering the opportunities for luxury marketers and managers in the redesign of their market offer (Wiedmann & Hennings, 2012).

Figure 1. The flowchart concerning the six phases.



Specifically, each article abstract has been read to verify its congruence with our research objective and its possible contribution. The final contributions have been deeply read, also manually reviewing each article's reference list to find other relevant articles, and then subjected them to the same screening process, not emerging from our database mining process (e.g., as for relevant articles published in

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the last year). Finally, the relevant findings and the related insight, has been analyzed from a critical perspective and grouped by five main emerging topics as in Table 1 below. The list of consulted journals is provided in the Appendix (see Table 2).

Table 1. Emerging topics and related main findings

Topic	Insights	Number of considered contributions
Technology & luxury hospitality	- Technology use to increase services' quality and perception of consumers, enriching experiences and satisfying them; - enhance company profitability and reduce human resource costs; - focused on management of billion people's Big Data and allows healthy competition between hotels;	51
Technology & luxury fashion	- Create attractive and innovative atmospheres though the use of digital; - Self-service technologies to support and advise customers both online and in store - Protection of brands counterfeiting	67
Technology & luxury tourism	- Enriched tourists' experiences (attractiveness); - Freedom to explore; tourists may be free to "manage" and customize their tour of museums, focusing on certain activities rather than others; - Low costs; museums are lowered as they no longer must hire guides;	48
Technology & luxury food	- Frequently used by new generations because they are more interested in physical fitness; - Oriental restaurants; - New consumers' experience in restaurant	28
Technology & luxury: Miscellanea	- Luxury beauty, self-care and technology; - Marked evolution and fusion between technology and biology; - Leisure and fun	30
	Total Contributions	224

FINDINGS

Technology and Luxury Hospitality

Towards the end of the last century and the beginning of the new millennium the world of new technologies profoundly impacted the luxury industries, supporting both business and individuals both in realizing new products and services, and creating unprecedent luxury experiences (Pappadà, 2019).

Recently, some luxury resorts decided to invest in technological innovations to reduce human resource costs and equally guarantee efficient services to customers (Ahmad & Scott, 2019) to revitalize and confer novelty to the whole experience (e.g., Amatulli et al., 2022; Sestino et al., 2020). Thanks to Information Technology (IT), defined as "the set of methods and technologies that are used in the realization

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of systems for the transmission, reception and processing of data" (Grazia, 2018) and its application in business processes, are increased quickly in the hospitality and tourism sector between 2005 and 2007 (Connolly & Lee, 2006); while thanks to Internet, network that facilitates the exchange of information between individuals and businesses (Zakrzewski et al., 2005) there has been the advent of e-commerce, especially among the new generations. Another step forward in the hospitality industry was taken by a luxury hotel chain in Japan where self-service technologies were adopted with the goal of improving service quality and perception, as well as the brand's own profitability (Kucukusta et al., 2014).

Moreover, globalization has prompted major hotels to equip themselves with increasingly avant-garde equipment capable of making services more usable and increasing customer loyalty and satisfying those who are looking for unique experiences (Zaitseva, 2016). Next to IT, in recent years hotels have adopted important technological innovations such as Internet of Things (IoT) to enrich consumers' experiences and satisfaction (Sestino et al., 2021), also by boosting the use of Online Travel Agencies (OTA) using OTA and thereby improving results (Moyeenudin et al., 2021). IoT is a set of devices connected to Internet, defined as "the use of standard Internet protocols for the human-to-thing or thing-to-thing communication in embedded networks" (Govinda & Saravanaguru, 2016), while OTA are defined "as travel agencies that obtain the majority of their revenue through online sales'' (Tsang et al., 2010). The world is evolving, and with-it people's needs are changing; OTA represents a good way to research hotels, especially for most important luxury brands, while it is more difficult for smaller establishments. OTAs are the most used tool by hotels that sell rooms and by customers who are looking for them: they allow them to select hotels according to needs, prices and strengthen competition between hotels (Chang et al., 2019). The OTA represents one of digital marketing strategies that highlights the discredit of hotels that do not employ them (Tooke-Marchant, 2015). Few studies have found that OTA help hotels in selling rooms online by websites and is funded by commissions that the hotels themselves pay, especially if they are small hotels or want a position at top of searches (Bastakis et al., 2004; Ling et al., 2011; Pan et al., 2013). Toh, Wu and colleagues have studied travellers' research websites before booking rooms through the same web sites or call centers, to have all the information they need (Toh et al., 2011; Wu et al., 2013). Literature shows that online bookings have quickly grown compared to direct bookings because travellers find transparent and lower prices, as well as the convenience of e-commerce and market segmentation by category of possible clients (Guo et al., 2013; Kim et al., 2003; O'Connor, 2003; Sahay, 2007). Hotels in cooperation with OTA, to make this marketing strategy more successful, must also guarantee customers the possibility of booking cancellation and dynamic pricing based on booking lead time and room occupancy rate (Guo et al., 2013). Next to OTA, hotels use IoT, that is defined as "the use of standard Internet protocols for the human-to-thing or thing-to-thing communication in embedded networks", and ICT that can have a lot of definitions, such as "devices and infrastructures that facilitate the transfer of information through digital means" (Zuppo, 2012). IoT uses cybernetics and remote connectivity to control physical objects and devices such as laptops, smartphones and other items in hotel rooms (Munir et al., 2017). In support of IoT can be a fog centric IFCIoT architecture that could increase performance and energy efficiency using the synergy between fog and cloud computing; whereas ICTs are used by tourism and hospitality industry to give information about the structure, the offers to consumers through an electronic platform (Babu & Subramoniam, 2016) and thanks to analytical processes to collect data from billion people (Irudeen & Samaraweera, 2013). The IoT uses sensors or smart devices, which can be communicated with each other directly or indirectly and can be used at any time and from anywhere creating an invisible smart network environment (Solanki and Nayyar, 2019). Some examples of IoT and ICT that exploit interchangeable big data are all those objects and

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appliances typical of smart homes such as lighting, heating or air conditioning, but also TV, audio and video entertainment systems, security systems conceived in a green background to reduce money and energy consumption.

Technology and Luxury Fashion

Technology is now assuming relevance in the fashion industry as well, both to support consumers during their shopping experiences according to a new shopping paradigm namely omnichannel (Amatulli et al., 2021; Sestino et al., 2021), and to support the fashion supply chain in certifying the production process (Burstall et al., 2017). We talk about wearable technologies with reference to smartwatches or all those articles desired by millennials, driven by hedonism and the utility they have as they are intended both as luxury fashion accessories and devices (Blazquez et al., 2020). From the brand's point of view, instead, technologies could help to arouse the consumer's interest: just think of web 2.0 technologies able to create an attractive and innovative online atmosphere (Bjørn-Andersen & Hansen, 2011). Even luxury brands have adopted marketing 2.0 by increasing the use of websites for e-commerce and product customization by shoppers (Lacroix & Riley, 2003; Serringhaus; 2005; Siddiqui et al., 2003). A profitable use of innovative technologies and the Internet is represented by the brand Cartier that has created a visual tour of the store brick-and-mortar that, involving the visitor, has allowed to intensify e-business: the customer has a cart at his disposal and there is a voice assistant that advises him in the choice of products on the shelves that can be moved into the cart. And like Cartier, many other luxury brands have begun to embrace websites to attract consumers who, however, to buy a luxury product, must go to the store otherwise "a luxury product sold on the internet isn't a luxury product anymore" (Kapferer & Bastien, 2009). Luxury brands adopt additional cutting-edge technologies such as voice assistants, IoT and Artificial intelligence in the store. Artificial intelligence, that is "the science and engineering of making intelligent machines, especially intelligent computer programs... related to the similar task of using computers to understand human intelligence, but AI does not have to confine itself to methods that are biologically observable" (McCarthy, 2007) may assume a fundamental role in the online environment (e.g., as for e-commerce applications), and in the offline environment (e.g., through the use of Artificial Intelligence-based smart object in the brand stores. In e-commerce there can be chatbots that become personal assistants, in physical stores technologies that become smart mirrors with assistant functions, in customer care the voice assistant that guides and supports the customer in all phases of purchase and post-purchase (Chung et al., 2017). Chatbots are a tool to collect a lot of information that can be used to cut costs and satisfy consumers in real time, becoming the future of marketing (Davenport et al., 2020; Rust 2020) because they allow segmenting consumers in real time through personalized messaging (Sutton, 2018).

Moreover, blockchain technologies, that's to say "a lot of information used by companies and compliant with the law with impacts on decision making and e-commerce profitability" (Burstall & Clark, 2017; De Boissieu et al., 2021), are often key to lowering the risks of counterfeiting caused by the advent of the grey market and avoiding risk to luxury brands (De Giovanni, 2020; Helo e Hao, 2019; Soon & Manning, 2019) or using technologies' integration in stores. However, this technology has been implemented in industries such as fashion, when luxury brands have had to guarantee luxury products' tracking, origin and transparency for consumers who buy them. Luxury industries also use online channels to respond to consumer demands (Nandi et al., 2020), intensifying luxury products' sales. In-store technologies represent great opportunities for retailers, and the gap between store and online is more and

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more blurred (Piotrowicz & Cuthbertson, 2014). This integration facilitates the collection of product usage information in the post-purchase phase (Sha & Guo-Liang, 2012), while the in-store technologies enable the interaction between consumers and retailers (Grewal et al., 2020).

Technology and Luxury Tourism

Technology is also common in the tourism sector, where there has been the advent of smart tourism destinations, i.e., destinations that take advantage of integrated systems of smart technologies to enhance the experience of travellers, such as RFID (Radio Frequency Automation Identification), intelligent chip, wireless communication technology, etc. (Weber et.al, 2010; Yunanguai, 2011). These include smart technologies found in hotels, but also beacons and QR codes for artwork, or even virtual reality for enjoying artistic experiences (Varghese, 2021). Tourism communication is supported by digital media and apps that are used mainly in the museum setting, where there are SMartArt-icons, QR-codes and beacon-bluetooth reality. The beacon-bluetooth technology involves the connection between the mobile device placed at a short distance from the beacon itself, thanks to which information is transmitted. In this way, the museum does not have to pay for guides and each visitor can use the service individually and freely (Cox, 2021). Museums also use another technology that is very common in today's world: QR-codes that are often placed next to the works or between the lines of information to allow visitors to get more information about the works or have access to additional multimedia objects such as video and audio. But despite their function, QR-codes are less used by visitors because they are not too interesting and exciting compared to smart icons or beacons. Another popular technology that is complementary to QR-codes and represents an alternative to beacons are the SMartArt icons, miniatures of the artworks that are placed next to them and that, when photographed, allow to get more information about the description of the work (Grimaldi & Natale, 2017).

Technology and Luxury Food

Also in this area, technology is linked to science with the idea of "reducing environmental impacts due to food production and getting food in areas where there are malnutrition problems" (Rubin, 2014). In fact, after these considerations, we talk about techfood such as nano-food and synthetic-meat and which are considered like "luxury meat": nano-food is defined as food which use "nanotechnology across the agri-food system, emerging from a growing alliance between the corporate food sector and scientific communities" (Scrinis & Lyons, 2007); while synthetic-meat or "in vitro meat" (Sapio, 2019) is a new meat's type realized in laboratory to reduce the use of "traditional" meat produced killing animals or exploiting the field. To respect the environment, technology is linked with luxury sustainability thanks to "Too Good To Go" app (TGTG) an anti-waste app created to reduce food waste and often used by companies to gift meals to the needy, such as the homeless (Vo-Thanh et al., 2021).

New technologies are widely employed in the food industry, especially among the new generation that uses technological devices to a large measure. Targeting Millennials and Gen Z, the large luxury brands in this sector have implemented the use of new technologies to create new experiences, thus extending the use of beacons to this area as well (Mendini et al., 2021). Beacons are mainly used in sushi restaurants, while it is still expanding in Western restaurants where, being placed under the dishes that flow on the conveyor belt, they allow the customer to receive all the information about the meal they have in front of them, such as price, ingredients, nutritional values or the origin of food (Cox, 2021).

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In support of all this are the IT that, in the hotel and restaurant sector, help consumers who get a lot of essential information in choosing the place to stay and eat, having unique experiences (Rizka & Syarif, 2020). Technology in luxury food industry is employed also to order food or during its consumption: for example, technology is represented by apps used by consumer users who order without having to call, that's to say online food delivery (Suhartanto et al., 2018) or in restaurants themselves where tablets have replaced notebooks for ordering.

Technology in Other Industries: Miscellanea

In the hyper-technological actual scenario, new technologies are profoundly impacting many other industries and applications, from cosmetic surgery with luxury clinics to relaxation, from SPAs to the sports sector. Particularly in cosmetic surgery there have been many innovations introduced, both related to the need and the welfare of the consumer. An innovative technological system is used for reconstruction 3D of bones using the computer and then implanted in patients (Wilde, 2015). In addition to technology for necessary medical treatments, such as reconstructions of damaged or non-existent body parts, there is also technology that supports cosmetic surgery interventions mainly dedicated to the care of beauty, appearance and fashion, especially desired by women who want to look beautiful (Venkatesh et al., 2010). These new technological tools are so innovative because they are not invasive but precise to hide scars: an example is the HIFU technology used for dermal rejuvenation or reduction of excess fat in luxury cosmetic surgery, as well as being used for the treatment of diseases (Camorani, 2015; Hu et al., 2007). Technology brings innovations in a lot of services that in recent years we also hear about the biotech body, which involves implanting biocompatible microchips under skin, a fusion of technology and biology (Mento & La Barbera, 2003).

Technology may also supports the luxury relaxation industry highly researched by the baby boomer generation (Cooper, 2009) represents by people who are "born after World War II, between 1946 and 1964" (Guido et al., 2018; Guido et al., 2020), especially from this one is also used to treat illness (Pecelj et al., 2010) and in sport sector, where there are digital coaching technologies replacing personal trainers (Eeva & Tuomas, 2018). Moreover, in the sport's world many technological innovations are risen that allow to young and adults to use of the simulators of game for the training; an example is multiball simulator born mainly to measure the heart rate of table tennis players recorded by Polar Team System (Katsikadelis et al., 2014), then employed by players to improve reaction time, power and speed of shots. However, virtual reality's fans are constantly updated and produce technological tools that let them play with 3D effects, using different models of viewers such as some types of google cardboard or daydream view supported by VR technologies (Balzani, 2016). These simulators are often employed in rehabilitation centers for patients who, after an operation, need physical activity to recover muscularly: an idea developed in the kayak paddling simulator that helps those who have undergone an operation not only physically, but also morally and psychologically (Natale, 2015).

CONCLUSION

This research is focused on the use of technology in the context of luxury, trying to understand the link between them. Thanks to examined articles, technology has radically changed production processes, sale of goods and the use of services, and consequently has influenced and still influences people's lives. All

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this has subsequently led to the evolution of the sectors classified in this article in five topics to carry out qualitative research that would help examine the phenomenon. Results shed light on five fundamental topics in terms of: hospitality, tourism, fashion, food and miscellanea, that's to say other industries.

Findings emphasize that the link between Internet and technologies is strong: industries and a lot of luxury brands use them over time. Innovation technologies help companies to segment products and services and attract new consumers. Technologies have grown thanks to the internet, becoming part of marketing strategies in every industry. In other words, technologies are present in every luxury's field: in some spheres they are predominant, in other ones they have difficulties to take off. Luxury hospitality and tourism are the sectors where technology is so important that brands invest to take care of consumers and satisfy them in every time and in every way. Tourist destinations in general, but also hotels, SPA, beauty centers use an information's thick network to connect the different types of consumers thanks to websites and OTA. These places can remember smart homes and represent an evolution of future smart cities. Managers can take advantage of this situation to create a new smart world focusing on the younger generation and raising awareness of the older ones. In fact, they could implement technologies with increasingly specialized manpower and human resources. According to these considerations, marketers could explore more and more the luxury food area, where technology is present, but it is not so predominant, while in hospitality, tourism, fashion and other industries could implement it. An idea could be to target older generations by allowing them to implement technology's use. Otherwise, industries couldn't cut human resources' costs, because the best solution is to fuse innovations, which are the future, with man who is the best machine ever.

While literature should study totally new sectors (such as the mechatronics of luxury vehicles such as planes, trains, cruises) or try to understand how technology can be combined in more manual jobs such as handicrafts.

This work contributes to the literature on technology by investigating the use of it in different industries which represent the five most important topics of this study. First, it helps to emphasize openness to change and technological innovation; however, this willingness to change is typical of new generations born into an already digitized world. Moreover, we contribute to the literature on technologies' openness by showing that it is faster in some areas than in others. Finally, we observed that technology can be a starting point for business strategies, not only the way to achieve certain results.

The limitations we have highlighted are related to the generational distinction: we need to investigate the level of technology knowledge of older generations and understand the propensity to use. In addition, excessive innovation in some industries can become a point of weakness, especially if the product is not appreciated by consumers.

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APPENDIX

Table 2. List of considered journal.

Journals	
Technovation	*Journal of IT and Economic Development*
Technology Analysis & Strategic Management	*European Journal of Operational Research*
Tourism Review	*Tourism management*
Journal of Fashion Marketing and Management	*Health and Wellness Tourism*
Journal of the Academy of Marketing Science	*Journal of Enterprise Information Management*
International Journal of Production Economics	*Rivista dei beni culturali*
Journal of Financial Services Marketing	*Journal of Customer Behaviour*
Journal of Translational Medicine	*Biology of Exercise*
Journal of China Tourism Research	*Marketing Intelligence & Planning*
IEEE Consum Electron Magazine	*International Journal of Innovative Science and Research Technology*
International Journal of Research in Marketing	*Sloan Management Review*
The International Journal of Sociology of Agriculture and Food	*Journal of Internet Commerce*
Micro & Macro Marketing	*Food Research International*
Journal of Foodservice Business Research	*Harvard Business Review*
Journal of Direct, Data and Digital Marketing Practice	*Journal of Travel & Tourism Marketing*
Journal of Consumer Psychology	*International Journal of Environmental and Science Education*
International Journal of Managing Information Technology	

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Chapter 23
Bibliometric Analysis of Supply Chain Digitalization

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ABSTRACT

"Digital transformation" or "digitalization" is a rapidly evolving concept that is gaining popularity in various different disciplines and highlighting a wealth of ideas, theoretical anchors, and research directions. In the present chapter, the authors try to understand the structure underlying research on supply chain digitization, the topics investigated which need more attention, how the existing literature could be classified, and how the discipline could be advanced. Using a bibliometric approach, this chapter analyzes 638 articles published between 1995 and 2020. The authors use VosWier to analyze the mapping information and Alceste for a detailed lexical analysis. The analyses reveal the main trends in supply chain digitalization and suggest an agenda for future research that includes a systemic approach to the analysis of digitalization, supply chain digitalization to create new strategic value, and digitalization as a dynamic capability.

INTRODUCTION

The growth of e-commerce has disrupted the transport and logistics sectors and reshaped the competitive environment. For multinational companies such as the e-commerce giant Amazon became a credible competitor when it began offering logistics services to its customers. Through the vertical integration of all its logistics activities and the size of its operations, Amazon is threatening the positions of established players and of its current logistics partners including USPS, FedEx, and UPS (Cheng, 2019). From a different perspective, the most promising start-ups are using algorithms and new transport optimization

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technologies to enhance their responsiveness and flexibility to offer innovative solutions to prospective customers, threatening incumbents' actual services. For all companies, the strength of an effective supply chain lies in its responsiveness and flexibility in all circumstances. Thanks to the development of information systems and information technologies, supply chain coordination has rapidly improved, impacting the extended supply chain which encompasses all suppliers and partners involved in production and distribution of goods. The digitalization of supply chains resulted in the optimization of products, costs, logistics, and deadlines and increased, in the end, the overall customer satisfaction (Mentzer et al., 2001). So, the digitalization of supply chain confers a competitive advantage, a differentiation, on which companies rely to be more competitive and more resilient, especially during pandemics periods.

As a result of this competitive advantage due to the digitalization of the supply chain, consumers, governments, and stakeholders expect companies to be socially, environmentally, and economically transparent (Chen and Paulraj, 2004; Manavalan and Jayakrishna, 2019). For practitioners "The digital supply chain enables the strategic supply chain transformations through design process optimization, product optimization, planning & inventory efficiency, risk management, supplier collaboration, operational efficiency, logistics optimization, sales optimization and after sales service" (Ageron et al., 2020). Today supply chain success is therefore tightly related to an effective information exchange capable to provide supply chain actors with the necessary information, traceability, and visibility.

While the role of information technologies in supply chains is a traditional theme in literature, the spree of innovation of recent years has increased the interest for both academics and practitioners in supply chain digitalization. The aim of the present chapter is to present a state-of-the-art review of supply chain digitalization literature. To achieve this, we conducted an extensive bibliometric analysis of the literature and addressed the following research questions:

Q1: How is academic research on supply chain digitalization structured?
Q2: What are the main topics dealt with in the existing literature?
Q3: What are the relevant issues which have yet to be discussed?

The chapter is organized as follows. The background section covers the digital revolution in supply chain operations insisting on its complexity. The section "Main focus of the chapter" describes the bibliometric analysis, the research protocol, and the results (based on linguistic analysis of keywords, paper titles and abstracts). Three complementary aspects of supply chain digitalization are identified and discussed: 1) the artificial intelligence and supply chain optimization techniques, 2) the role of big data, and 3) smart manufacturing digital technologies. The "Solutions and recommendations" section presents three trends in supply chain digitalization emerging from the literature and identified by the cluster analysis: 1) the artificial intelligence to improve quality and efficiency of supply chain management, improve human decision-making processes, and increase productivity, 2) digitization, digitalization and big data are the drivers of supply chain agility and business resilience to risk, and 3) industry 4.0 technologies are enabling smart manufacturing in a global context. The "Future research directions" section proposes three directions for future research: 1) a systemic approach to analysis of supply chain digitalization, 2) digitalization leads to a rethinking of performance and 3) beyond innovative digitalization technologies, dynamic capabilities are at the core of performance and a systemic approach. Then, we conclude this chapter in the last section.

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BACKGROUND

Several articles in the professional and academic press consider digitalization a critical managerial issue. A recent consulting reports (Accenture, 2017) points out that the world is being transformed by new technologies which are redefining customers' expectations, enabling companies to meet those expectations, and changing how people live and work. Digital transformation, which is affecting not only to the organization but also the society and industry (Stank et al., 2019, Makinde et al., 2022), is considered as "*a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies*" (Vial, 2019).

Digitalization has immense potential to change the lives of consumers and to create value for businesses. Beyond its capacity for dematerialization and transmission, digitalization refers to the integration and digital transformation of processes that render digital technologies infrastructural (Rodriguez and Piccoli, 2018; Tilson et al., 2010). According to a Capgemini (2018) survey, despite its complexity, supply chain digitization is a top organizational priority. Half of the respondents considered it among the top-three strategic priorities of several organizations. A recent study by Gartner (2019) confirms these findings and highlights that 74% of supply chain users consider digital business extremely important. Interestingly, the same study found that while companies see digital as a business imperative and are investing (76%), 54% remain in an exploration phase, and only 10% have fully deployed one or more digital initiatives (Klappich *et al*., 2019).

In supply chain operations, the digital transformation has been a major driver of business success. On the one hand, the increased adoption of new technologies and technological devices has redefined customers' expectations, habits, and work; on the other hand, it has enabled firms to respond to this new demand (Ogah, & Onuoha, 2022). Digitalization of the supply chain, digital technologies, and digitized data are affecting how work gets done, transforming how customers and companies engage and interact, and creating new (digital) revenue streams. According to Cecere (2016) *"a digital supply chain process uses new technologies to define processes to sense, respond and orchestrate bidirectionally from market to market (from the channel to supplier networks). The processes move at the cadence of the market"*. Hess et al. (2016: 124) state also that: *digital transformation is concerned with the changes digital technologies can bring about in a company's business model, which result in changed products or organizational structures or in the automation of processes …* [and that] *a digital supply chain process uses new technologies to define processes to sense, respond and orchestrate bidirectionally from market to market (from the channel to supplier networks).*

So, on a global scale, digitization appears to be a complex phenomenon at the intersection of different business and management fields.

The leaders in digital supply chain management are building financial advantage that becomes more difficult to overcome with each year based on digital innovations. Big data analytics, cloud applications, the IoT (Internet Of Things), blockchain, robotics, AI (Artificial Intelligence), and autonomous vehicles are heralding increasingly digitalized supply chain management. Digitalization is not just about automation; the main benefit is inside the data. Digitalization of the supply chain will contribute to firms' competitive advantage through partner integration, greater visibility, a more cost-effective cloud infrastructure, and streamlined financial transactions (Korpela et al., 2017; Shevtshenko, et al. 2022). Although digitalization is in its infancy it is leading to a dynamic of change and innovation in supply chains (Büyüközkan and Göçer, 2018).

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The phenomenon has reached the point where keeping up with the pace of innovations, and new tools has become difficult, making both academic and practitioners struggle in gaining perspective on the phenomenon. To fill this gap, the present chapter represent a first systematic assessment of the digitalization process in supply chains.

MAIN FOCUS OF THE CHAPTER

Bibliometrics Analysis

Our aim is to provide a comprehensive and precise understanding of the concept of supply chain digitalization. Thus, we use rigorous bibliometric tools to assess the literature and contribute to the accumulation of the knowledge related to digitalization in the supply chain domain, a necessary step in such a diverse body of knowledge (Transfield et al. (2003). Bibliometric analysis uses a quantitative linguistic technique based on application of statistical and mathematical methods to sets of bibliographic references in the academic literature (Quoniam et al., 1993; Perrier et al., 2016). Many research fields use bibliometric methods to describe scientific research patterns, or explore new concepts (Chen et al., 2016; Gaviria-Marin et al., 2018).

In logistics research, bibliometric methods are used frequently to address supply chain issues (Charvet et al., 2008, Fahimnia et al., 2015; Mishra et al., 2018.). In recent years, several bibliometric studies of digitalization have been published (see Appendix 1), specifically on industry 4.0 (Cobo et al., 2018, Muhuri et al., 2019), big data (Aykroyd et al., 2019, Ardito et al., 2018, Mishra et al., 2018), and Artificial Intelligence (Liang and Liu, 2018). Most of these works refer to the years 2005 to 2018 (e.g. Ardito et al., 2018, Muhuri et al., 2019). The number of articles reviewed varies between 107 (Trotta and Garengo, 2018) and 20,239 (De Oliviera et al., 2019). Methodologically, although various software can be used for bibliometric analysis (e.g. BibExcel and CiteSpace), VOSViewer is the most frequent choice.

This survey shows us that it is important to consider several software to overcome the methodological limitations identified in the literature.

Our bibliometric analysis methodology includes 638 articles published between 1995 and 2020. The originality of our methodology is based on the combine information mapping and lexical analysis leveraging two different tools such as Vosviewer (to map the information) and Alceste (which allows detailed lexical analysis). Interestingly, this innovative approach contributes to advance systematic literature methods.

Vosviewer maps the information and "create[s] maps based on data such as: the networks of scientific publications, scientific journals, researchers, research organizations, countries, keywords, or terms". Each item can be connected by various links: "co-authorship, co-occurrence, citation, bibliographic coupling, or co-citation. In the network visualization, items are represented by their label and by default also by a circle" (https://www.vosviewer.com/documentation/Manual_VOSviewer_1.6.8.pdf). Vosviewer was used to visualize the scientific network.

We employed ALCESTE (Lexical Analysis by Context of a Set of Text Segments) software to conduct a content analysis. ALCESTE software allows bibliometric analysis based on textual data. It allows detailed analysis of the vocabulary in a corpus of texts. Lexical analysis allows identification of hierarchical semantic universes specific to the corpus. "Then, by successive fractionations, it divides the text into homogeneous segments containing a sufficient number of words, and proceeds to a classification

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of these segments by locating the strongest oppositions. This method makes it possible to extract classes of meaning, constituted by the most significant words and sentences, the obtained classes represent the dominant ideas and themes of the corpus. All the results sorted according to their relevance, accompanied by several graphic representations" (https://www.image-zafar.com/Logicieluk.html).

Research Protocol

This study employs a stepwise bibliometric approach which selects items according to different criteria (David and Han (2004), Newbert (2007), Macpherson and Holt (2007), and Mishra et al. (2018). The protocol started with 4,554 articles and the final data set includes 638 articles. The analysis involves the following steps (see appendix 2).

- **Step 1- Database**. We focus on published articles from the Business Source Complet, Science Direct, and Scopus databases.
- **Step 2- Topic based on keywords**. We ensured relevance by requiring that selected articles contained the terms "digital*" and "supply chain", in their titles, keywords list, or abstracts.
- **Step 3- Additional keywords.** Based on the definitions in introduction section, we ensured substantive relevance by requiring also that the selected articles referred to the "IOT", "technolog*, "4.0", "big data analytics", or "artificial intelligence".
- **Step 4- Type of publication.** The review was restricted to peer reviewed published academic articles and proceedings of annual conferences (i.e. excluding books, and book chapters). For consistence, we retained only the English language, the most frequent language for peer reviewed research papers.
- **Step 5- Type of content.** We ensured all the articles and conference proceedings had empirical and/or theoretical content
- **Step 6- Editorial choices.** We imposed no specific period to allow coverage of the full range of possibilities.
- **Step 7- Coherence.** We excluded duplicate articles and incomplete citations.
- **Step 8- Verification**. We ensured substantive and empirical relevance by reading all the abstracts in the final sample.
- **Step 9- Consolidation.** To ensured substantive contextual and empirical relevance, we read all of the remaining articles in their entirety.
- The results were exported to Endnote bibliographic software and the resulting database was analyzed using Alceste software and Vosviewer.

Results

Data collection (steps 1 to 6 of the research protocol) identified 2,738 articles which was reduced to 638 following completion of steps 7 to 9 of the research protocol. The 638 articles involve 1,750 authors and 330 different peer-reviewed journals, published between 1995 and 2020.

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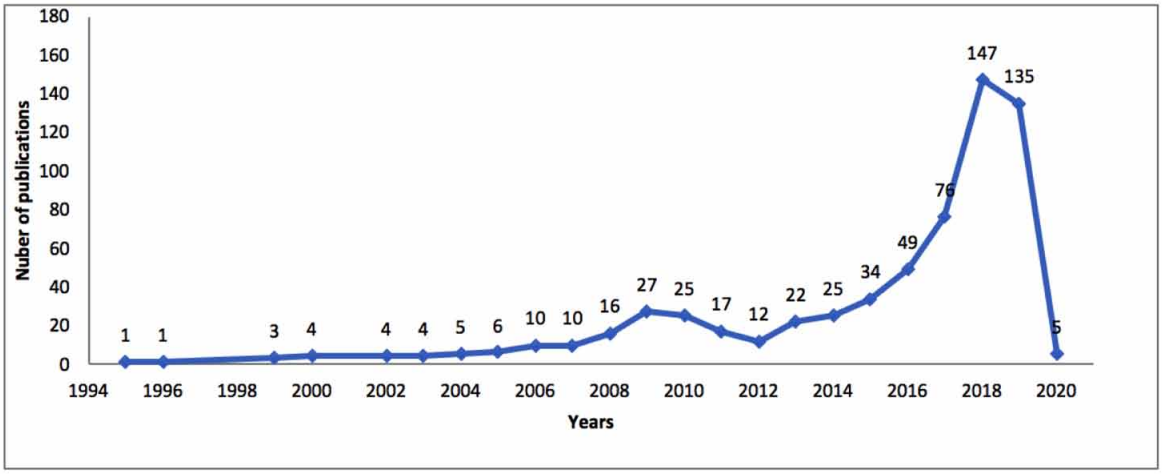
Results 1: Statistic Bibliometric Outcomes

This subsection presents: the annual number of publications, the most productive journals and subject areas that show the structure of the literature (answer to research question 1), the most prominent authors and the analysis of the bibliographical references in the 638 articles.

Annual Number of Publications

Time analysis indicates that since Leung's (1995) seminal article, the amount of research on supply chain digitalization has increased steadily up to 2020 with a peak in 2018 (147 publications, almost twice the number published in the previous year – see figure 1).

Figure 1. Number of publications per year (N= 638)



Leung's study was published originally in the *Proceedings of the 1995 IEEE Annual International Engineering Management Conference* and focuses on neural networks in supply chain management. It explains how neural networks contribute to supply chain management, and according to Lueng (1995, p. 348) "*A supply chain is defined as a collection of business centers through which products pass at various stages of completion from the provision of raw materials to final sales*". Lueng considers that neural networks complement primary and auxiliary problem-solving methodologies and the then current techniques (e.g., expert systems). In the context of supply chain management, neural networks can contribute significantly to optimization, forecasting, modeling and simulation, and decision-making support.

During the first ten years, from 1995 to 2005, the number of articles on supply chain digitalization was small (28) but increased slowly between 2006 and 2014, to reach a total of 164 publications. Between 2016 and January 2020, research interest increased resulting in 446 published papers. Most of these were published in the last three years considered i.e., 69.9% of all publications. Thus, interest in supply chain digitalization continues to inspire academic work. The peak in 2018 is evidence of the increased academic interest in supply chain digitalization in more recent years. This can be explained by various

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factors operating concurrently which include the IoT, big data, and AI, development and accessibility of information systems and information technology, and consumer demand for more traceability and visibility.

The Most Productive Journals and Subject Areas: Structure of the Literature

The number of peer-reviewed scientific papers published in a specific journal is evidence of interest in supply chain digitalization in that particular field. While there is a group of journals which account for a significant number of articles and form the core of the database of articles (see table 1), no one publication dominates. Various scientific disciplines are interested in supply chain digitalization (see table 2) as indicated by the journal subject areas. To obtain a picture of the range of fields, we associated journals to subject areas according to the SCImago Journal & Country Rank (https://www.scimagojr.com/). The SCImago index is based on Elsevier's Scopus database and contains an exhaustive list of keywords and levels covering all the publications in the databases selected in our research protocol (see step 1).

This indexing allowed us to identify the subjects covered in the journals and conferences proceedings included in our database. Subject areas represent how the literature is structured.

The journals considered cover several research areas ranging from more technical computer science and engineering domains to articles with implications for business and management. The majority of the journals are related to engineering and manufacturing which suggests that research on supply chain digitalization is multidisciplinary.

Table 1. The most cited journals and conferences

Journals or conferences	Articles/journals or conferences	Subject areas
International Journal of Production Economics	21	**Business, Management and Accounting; Decision Sciences; Economics, Econometrics and Finance; Engineering**
Procedia CIRP	20	**Engineering**
Journal of cleaner production	18	**Business, Management and Accounting; Energy; Engineering; Environmental Science**
International journal of production research	18	**Business, Management and Accounting; Decision Sciences; Engineering**
International Journal of information Management	17	**Computer Science; Social Sciences**
Computers & industrial engineering	17	**Computer Science; Engineering**
Procedia Manufacturing	17	**Computer Science; Engineering**
Transportation research part E: Logistics	10	**Business, Management and Accounting; Decision Sciences; Engineering; Social Sciences**
Decision support systems	10	**Arts and Humanities; Business, Management and Accounting; Computer Science; Decision Sciences; Psychology**
Computers industry	10	**Computer Science; Engineering**
Supply Chain Management	**10**	**Business, Management and Accounting**

Note: Journals with less than 10 articles are not included in the table

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Most Prominent Authors

The 638 articles were written by 1,750 authors (Appendix 3-1). *"The number of a paper's co-signers (or co-authors) is an indicator of co-operation at national or international level"* (Okubo 1997, p. 25). Co-authorships analysis provides information on 1) the scientific orientation and dynamism of a university and/or a country, 2) its impact on both the national and international communities, and 3) scientific networks. There is a clear trend towards diverse collaboration and co-authorship which is explained by the multidisciplinarity referred to above. For example, appendix 3-2. shows that 102 authors published twice and that 16 papers are attributable to just one author. Among the most frequent authors in our database, six have strong collaboration links (see appendix 3-3).

Analysis of the Bibliographical References in the 638 Articles and the Theoretical Basis of the Literature

According to Okubo (1997, p. 17) "*citations are a measure of the overall impact of an article's influence, or that of its authors, on the scientific community; they are a complex socio-epistemological parameter which probably induces a quality factor, but this factor is neither equivalent to, nor unequivocally correlated with, scientific quality"*. Table 2 lists the most cited authors and the most frequently cited articles (founding article cited more than 15 times) (for authors frequently cited in the references to articles more than 40 citations, see appendix 4).

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Table 2. The top most cited authors and the major articles

Authors		Article	
Name	**Citations in references**	**Title**	**Count**
Wang, G., **Gunasekaran, A.,** **Ngai, E.W.,** **Papadopoulos T.**	52 86 21 68	Wang, G., Gunasekaran, A., Ngai, E.W., Papadopoulos, T., (2016), Big data analytics in logistics and supply chain management: certain investigations for research and applications, International Journal of Production Economics, 176 (6), pp. 98-110.	25
Hazen, B.T., **Boone, C.A.,** **Ezell, J.D.,** **Jones-Farmer, L.,**	68 32 24 28	Hazen, B.T., Boone, C.A., Ezell, J.D., Jones-Farmer, L.A., (2014), Data quality for data science, predictive analytics, and big data in supply chain management: an introduction to the problem and suggestions for research and applications, International Journal of Production Economics, 154 (8), pp. 72-80	24
Chopra, S., **Meindl, P.,**	35 19	Chopra, S., Meindl, P., (2001), Supply Chain Management: Strategy, Planning, and Operation, Prentice-Hall, New Jersey	22
Chen, H., **Chiang, R.H.,** **Storey, V.C.**	36 18 18	Chen, H., Chiang, R.H., Storey, V.C., (2012), Business intelligence and analytics: From big data to big impact MIS Quarterly, 4, pp. 1165-1188	19
Waller, M.A., **Fawcett, S.E.**	40 38	Waller, M.A., Fawcett, S.E., (2013), Data science, predictive analytics, and big data: a revolution that will transform supply chain design and management, Journal of Business Logistics, 34 (2), pp. 77-84	19
Tan, K.H., **Zhan, Y.Z.,** **Ji, G.,** **Ye, F.,** **Chang, C.,**	40 20 16 18 36	Tan, K.H., Zhan, Y.Z., Ji, G., Ye, F., Chang, C., (2015), Harvesting big data to enhance supply chain innovation capabilities: an analytic infrastructure based on deduction graph, International Journal of Production Economics, 165 (7), pp. 223-233	17
Christopher, M.	47	Christopher, M., (1992), Logistic and Supply Chain Management, Pitman Publishing, London.	16
Seuring, S., **Müller, M.**	43 46	Seuring, S., Müller, M., (2008), From a literature review to a conceptual framework for sustainable supply chain management, Journal of Cleaner Production, 16 (15), pp. 1699-1710	16
Swaminathan, J., **Smith, S.F.,** **Sadeh, N.M.,**	22 18 28	Swaminathan, J.M., Smith, S.F., Sadeh, N.M., (1998), Modeling supply chain dynamics: a multiagent approach, Decision Sciences Journal, 29 (3), pp. 607-632	16

Notes: Count refers to the number of times the article is cited in the bibliographies of the 638 articles in our database. Citations in references is the number of articles written by the author and referenced in the bibliographies of the 638 articles in our database.

Over the years analyzed, t most frequently cited authors writing on supply chain digitalization, published work on closely related issues. They study supply chain traceability, tracking/tracing, and visibility, and investigate the place and role of information systems and information technology in the manufacturing industry and in supply chain management more broadly.

Results 2: Analysis of Key Words Abstracts

This subsection presents an analysis of keys words and abstracts to highlight the main themes addressed in the existing literature (first part of answer to research question 2).

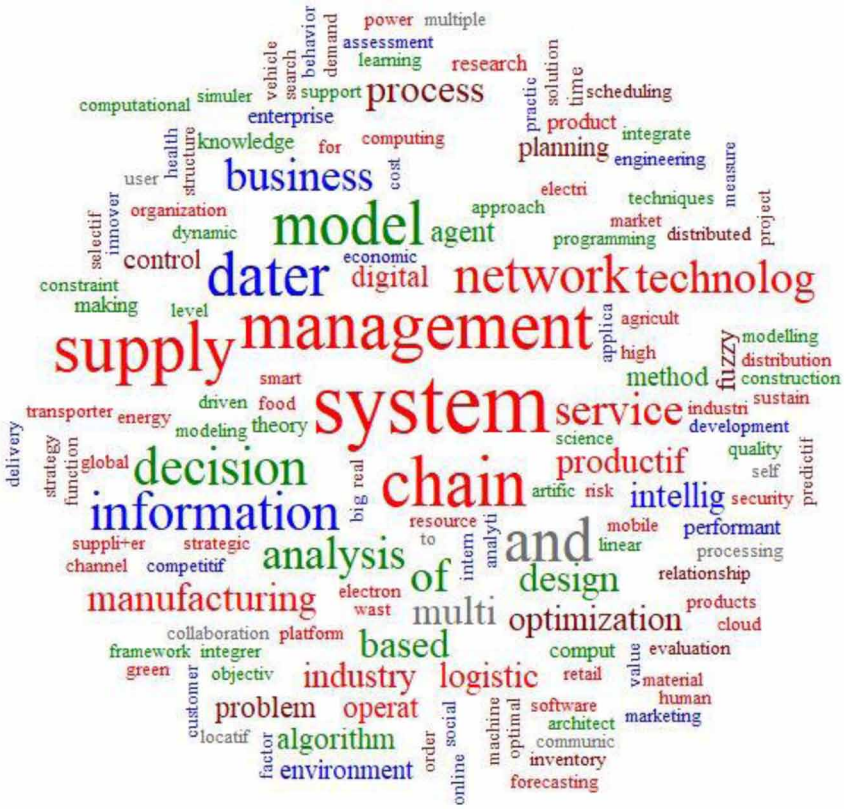
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Analysis of Key Words

The occurrence index measures the number of times a keyword appears in the documents being analyzed. The keywords are those placed on the first page of the article, usually after the abstract. Total link strength indicates the strength of the connection between a one keyword and the others. To analyze occurrence, we proceeded as follows.

First, for the lexical analysis of keyword clusters, we used Alceste software (see figure 2). The co-occurrence of each word with some other word was analyzed and the frequency identified. The keywords are specific to each research subject and tend to be chosen by the authors from expert classifications (such as the *Journal of Economic Literature* editor's classification). Second, we conducted cluster analysis and identified the chronological evolution of keywords using VosViewer software (see figure 3). Based on the words identified we can visualize major research subjects and study their chronological evolution. Okubo (1997, p. 31) states that "*In scientific papers and patents, the presence of these words reflects a likeness of intellectual concepts among researchers. They are therefore like signals, indicating associations which can be represented in the form of lexical graphics*" such as proposed by Vosviewer.

Figure 2. Keyword analysis using Alceste software
Note: Alceste identifies occurrence, frequencies, and links. It allows different linguistic analyses based on a dictionary of the complete corpus of forms. It creates clusters of linked keywords.

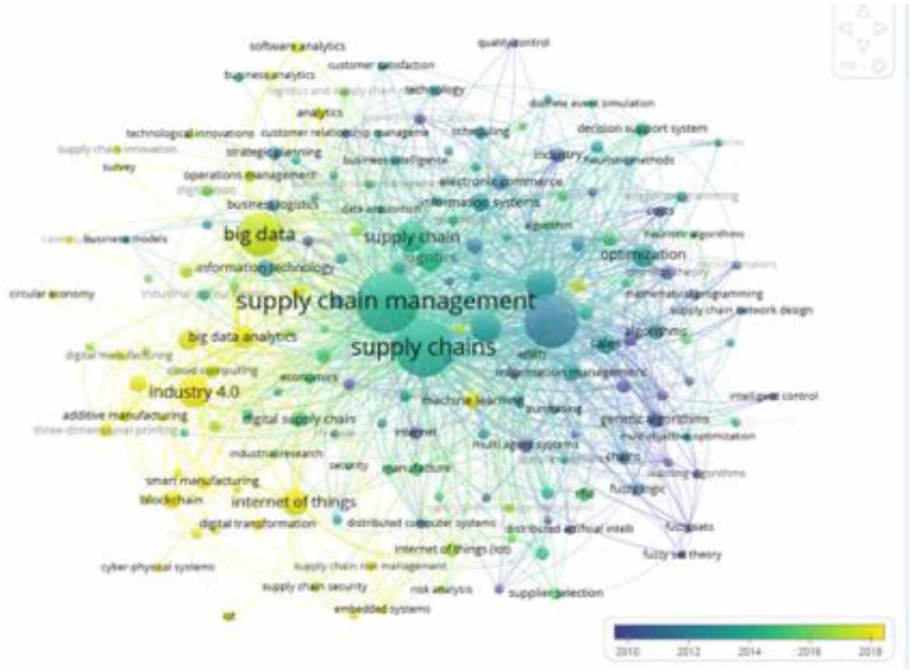


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The most frequent keywords are: Supply chain* (452 occurrences), Supply chain management (276), Artificial intelligen*(204), Big data (136), Decision support (98), Decision mak* (93), Sustainable*(85), Logistic* (82), Industry 4.0 (72), Manufactur* (72), RFID (60), Optimizat*(57), Manage* (53), Business* (48), Smart*(47), Big data analytics (47), Digital (44), Blockchain (38), Operat*(38), Technolog*(36), Transport*(35), Strategy*(34), and Multi-agent*(32).

Figure 3. Overlay visualization of keywords using VosViewer

Note: VosViewer allows an "overlay visualization" of the co-occurrence of keywords in a temporal chronology. This color the different items. The default colors range from blue (lowest score) to green, to yellow (highest score), and allows a density visualization. The size of the label and the circle attached to an item are determined by the weight of the item. The higher the item weight, the larger the label and the circle.



In the period 1995-2012 (145 articles*)* (the digital era) physical distribution and logistics management was considered (David, 1999) an intelligent problem (Rowe et al., 1996) which could be solved using AI (the dominant keyword). Supply chain management inbound, outbound, storage management optimization problems (e.g. planning, scheduling, constraints management), and decision-making were addressed by AI models. Several AI models where proposed and tested between 1995 and 2005 including neural networks (Leung, 1995; Tah, 2005), multi-agent models (Yung and Yang, 1999; Zang, et al., 2003; Zhao et al., 2004; Carvalho and Custódio, 2005; Pardoe and Stone, 2006), genetic algorithms (Taniguchi and Terano, 2005; Yandraet al., 2007; Kannan, et al., 2009), meta-heuristics models (Silva et al., 2003), automatic data collection systems (Singh, 2003; Rowe et al., 1996). and digital networks (Wynarczyk, 2000; Nissen and Mehra, 1999). In the last six years of the period analyzed, new AI methods such as Fuzzy sets (Ates and Cevik, 2006; Ustundag and Tanyas, 2006; Jain et al., 2008; Yandra, et al., 2007;

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Ustundag, 2012) and ant colony optimization algorithms (Wang and Yu, 2010, Wong et al., 2009, Liao and Chang, 2010, Zhang, et al., 2010, Utama et al., 2011; Zhao et al., 2012; Xiao, et al., 2012) emerged.

There was an evolution in the methodologies employed during the period analyzed. In the first 10 years most studies were theoretical and employed mostly decision-making models and simulations (Xie and Rui, 2010, Zhao, 2011, Yang et al., 2010). Several papers examined supply chain businesses (Tremblay, 2006; Rai, et al., 2006; Chan et al., 2006; Stefanovic and Stefanovic, 2009; Tremblay et al., 2009; Yee et al., 2010) using these models (Wang, et al., 2009, Yang, 2011; Zhao, 2011; Yadati et al., 2010) and the accompanying knowledge (Zhang et al., 2007; Yue et al., 2007), and focusing on the impacts of intelligent supply chains on cost control (Kovalchuk and Fasli, 2008) and customer satisfaction (Kovalchuk and Fasli, 2008, Tang & Lau, 2009). The contingency digital content production, distribution, and consumption models were studied in the context of digital printing (Papagiannidis, et al., 2008; Burgess, et al., 2006).

During the period 2013-2015 (81 articles), keywords frequency underlines that information systems and information technologies are essentially supply chain and logistics elements but that their successful management relies on an intelligent supply chain (Lv and Yu, 2013; Hahn and Packowski, 2015; Hu and Monahan, 2015) and coordinated decision making across the logistics network (Zhang and Yao, 2014). A change in focus from production lines and individual organizations to entire supply chains can increase competitive advantage. Coordination of supply chain management is based on intelligent decision making and decision analysis using intelligent support systems, computational intelligence techniques, AI tools, and efficient big data analytics. AI tends to be significant (Wong, et al., 2013; Wang, et al., 2013). The two main approaches to study supply chain managements are fuzzy set theory (Zhang et al., 2014; Turk et al., 2014; Xiang et al., 2014; Orji and Wei, 2015) to study risk (Yin, 2013), and ant colony algorithms (Wong et al., 2014; Vieira, et al., 2015) to study supply chain optimization. Studies of supply chain digitalization include the keywords: digitization (Xue, 2014; Xue et al., 2013), digital supply chain (Hajdul and Persi, 2013; Baumers et al., 2013; Holmström and Partanen, 2014; Hajdul and Mindur, 2015), IoT (Li et al., 2013; Verdouw et al., 2013), cloud computing (Radke and Tseng, 2015; Kiselicki et al., 2015; Wu et al., 2015). And big data (Waller and Fawcett, 2013a,b; Zhang and Gong, 2014; Robak et al., 2013; Fawcett and Waller, 2014; Kambatla et al., 2014; Milliken, 2014; Wamba and Akter, 2015; Schoenherr and Speier-Pero, 2015; Yan et al., 2015; Tan et al., 2015; Russo et al., 2015; Zhong et al., 2015; Ziora, 2015 among others). Decision making and support systems (Zhang, 2014; Ting et al., 2014; Yan et al., 2014; Hahn and Packowski, 2015; Peiris et al., 2015; Zhang, 2015) are crucial for manufacturing industry supply chains. They help optimize strategies and resolve supply chain management problems (Ting et al., 2014; Wortmann et al., 2013)

During the period 2016-2020 (412 articles), the most influential works are those that examine the role of data in supply chains in the form of big data; numerous articles focus on the role and capabilities of big data in decision making. Decision-making based on multiple criteria is examined frequently using multi-agent models which help decision-makers involved in complex supply chains, optimize the information available. Providing support for greater agility and efficiency brings performance gains. For example, it allows exploration of the most important contributors to supply chain risks and uncertainties (Gunasekaran et al., 2018; Mandal 2018; Tsao, 2017; Wu et al., 2017; Li and Liu, 2019; Dubey et al., 2018; Jeble et al., 2018) or provides a better understanding of the value of big data in supply chain management and business processes (Brinch, 2018). The links between industry 4.0 and supply chains (Barreto, et al., 2017) are discussed extensively based on innovative practices such as: 3D printing technology (Cerdas et al., 2017; Chan et al., 2018; Aquino et al., 2018), the IoT (Shah and Ververi, 2018; Witkowski, 2017),

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blockchain technology (Susilo and Triana, 2018 ; Perboli et al., 2018; Wong et al., 2019; Choi et al., 2019; Saberi et al., 2019 ; Mushtaq and Haq, 2019), and digital technology (Agrawal and Narain, 2018). More specifically, they investigate the impact of digital technology on the ripple effect and supply chain risk analytics (Ivanov et al., 2019; Das et al., 2019; Tupa et al., 2017) or performance (Chakravorty et al., 2018) and machine learning and data-driven simulation of supplier selection in digital manufacturing (Ariyawansa & Aponso, 2016; Cavalcante et al., 2019; Canitz, 2019). This period includes numerous methodological contributions in the form of literature reviews and theoretical research frameworks to study big data analytics in supply chain management (Meissner et al., 2018; Nguyen et al 2018; da Silva et al., 2019) in different sectors. Empirical investigations and predictive analyses approaches examine the adoption, benefits, and risks related to companies' use of big data technologies (Raguseo, 2018; Queiroz & Fosso Wamba, 2019; Wahab et al 2018; Sodero et al., 2019, among others). It also includes several case studies which complement the more quantitative methodologies and provide a more detailed understanding of the problems and challenges related to big data in supply chain management (Tönnissen and Teuteberg, 2019; Queiroz and Foso Wamba, 2019). In this period, we observe the first studies of sustainability and digitalization in supply chains, and work on the circular economy. Keywords refer most to the technologies allowing supply chain innovations.

Analysis of Abstracts

Figure 4 depicts cluster analysis of article abstracts. Since abstracts are expected to summarize objectives, methods, and findings more comprehensively than paper titles and/or keywords, we decided to analyze the papers' abstracts. They are represented as lexical cartography (cf. figure 5 - Alceste) and depict a chronology of (cf. Figure 4 - VosViewer) lower frequency trends. We observe three periods - 1995-2015, 2016-2017 and 2018-January 2020 as for the keyword analysis. Abstracts contain more words (names, verbs, adjectives, adverbs, etc.) than keywords, and provide more detail on the article content which allows contextualization (time, place, country, etc.). The abstracts analysis complements the keywords analysis. It identifies more word cooccurrences. However, it mitigates some aspects because all words are not included in the abstracts. It offers a different lexical mapping and chronological evolution to the previous ones.

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Figure 4. Map of overlay visualization of abstracts and chronology by VosViewer

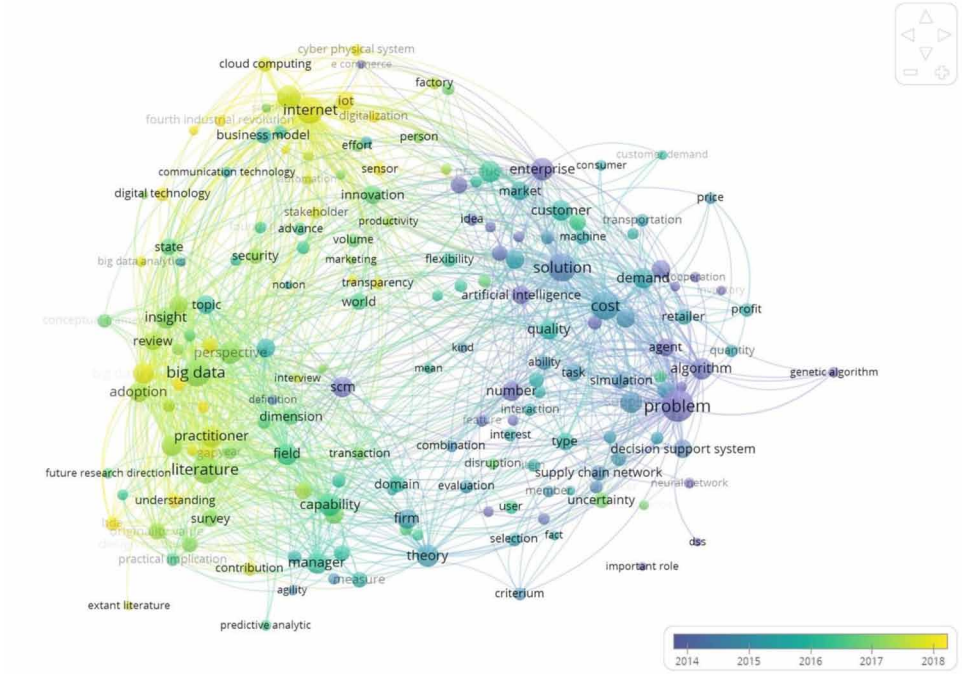
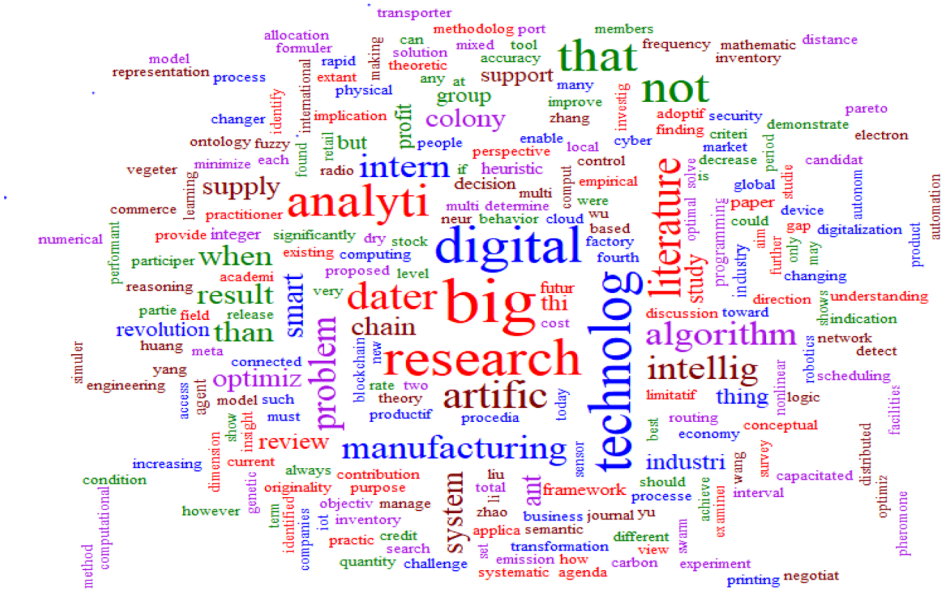


Figure 5. Alceste world cloud of abstracts

Note: Alceste software allows different linguistic analyses based on a dictionary of the complete corpus forms (in our case: 141,391 forms - words, numbers, verbs, personal pronouns, etc.). Vocabulary richness is 98.85%. Alceste was used to produce a list of reduced forms representing several key words (e.g. manage = manager, management…). These reduced forms are ranked in descending order in the corpus (in our case, at least 500 occurrences).*

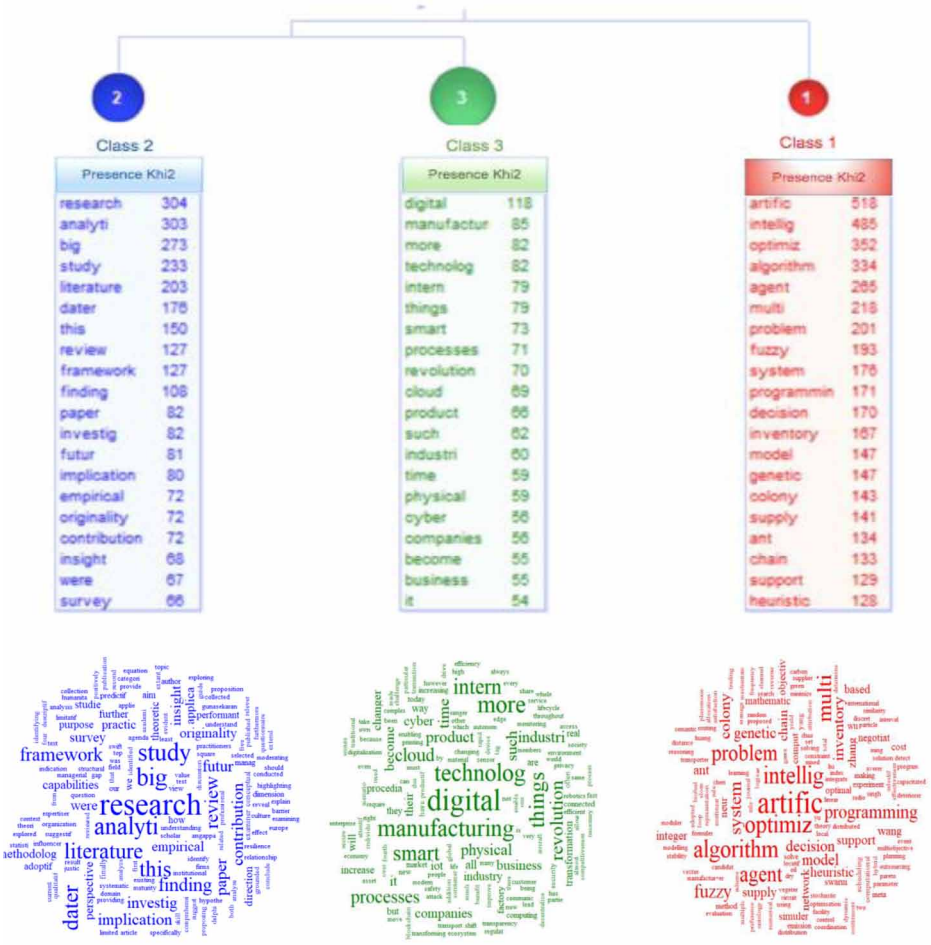


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The top keywords include: Supply chain* (2712), Dat* (1486), Manage* (1291), System* (1123), Technolog* (813), Big data (756), Decision* (747), Model* (692), Research* (641), Information* (638), Manufacturing (637), Industr* (586).

An additional analysis was performed using the descending hierarchical classification option available in Alceste to cluster the articles based on lexical proximity which identified the main topics in the corpus of research on supply chain digitalization. 83% of corpus text units were classified as relevant, and the remaining 17% were excluded from the analysis. We obtained three clusters which cover the main topics and dimensions shown to be decisive for understanding supply chain digitalization (figure 6). Each cluster is numbered and colored according to their order in the classification.

Figure 6. Dendrogram into three clusters



Cluster 1 (red – Alceste) refers to AI and supply chain optimization techniques.

This cluster is the most specific of the three because it was the first to be detached from the classification tree. Compared to the other clusters, the vocabulary is more homogeneous. Cluster 1 represents 25% of the classified text units and is characterized by words such as artific*, intellig*, optimiz*, algorithm*,

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agent, multi*. The main but not the only authors of the articles in this cluster are Taniguci and Terano, 2004, 2005; Wu et al., 2008**;** Jain and Benyoucef, 2008; Wong et al., 2009; Tsadikovich et al., 2010; Wong and Fang, 2010; Utama et al., 2011; Xin, 2011; Zhao et al., 2012; Sadrnia et al., 2013; Wong and Moin, 2014; Tiwari et al., 2015; Zhang et al., 2016; Rezaei et al., 2017, 2018; Wang et al., 2019; Zair et al., 2019; Zhanguo et al., 2019.

Cluster 1 examines the long-term evolution of the main trends and techniques in supply chain management practices. From multi-agent coordination approaches to different artificial intelligence methods and models, the aim is to support manager's decision making about the supply chain using value-adding digital services to reduce costs and optimize logistics value.

Cluster 2 (blue - Alceste) refers to the links between digitalization and big data.

It accounts for 33% of the classified text units and the significant words are research*, analyti*, big, study, literature, date. The main but not the only authors and articles with significant representation in the cluster are: Saggi et al., 2018; Brinch, 2018 a,b; Lai et al., 2018; Gravili et al., 2018; Ding, 2018 ; De Camargo Fiorini et al., 2018 ; Dubey et al., 2018a,b,c, 2019a,b; Mandal, 2018 ; Arunachalam et al., 2018; Lai et al., 2018; Wei et al., 2019; ; and Singh and Singh, 2019.

Cluster 2 includes research on the links between big data and digitization trends in supply chain management. Big data is reshaping supply chain management by increasing production efficiency, operations optimization, and resilience.

Cluster 3 (green - Alceste) refers to smart manufacturing digital technologies.

It accounts for 42% of the classified text units and includes the key words digital*, manufacturing, technolog*, intern*, things. The main but not the only authors and articles with significant representation in the cluster are: Attaran, 2017; Tuptuk and Hailes, 2017; Majeed and Rupasinghe, 2017; Shah and Ververi, 2018; Menon et al., 2018; Rahman and Rahim, 2018; Mandolla et al., 2019; and Mushtaq and Haq, 2019.

Cluster 3 represents the challenges (flexibility and uncertainty, responsiveness and agility, robustness and security, data consistency and confidentiality, etc.) posed by the concept of intelligent manufacturing in various industries and the solutions and models proposed in the literature using industry 4.0 digital technologies.

Each of the three clusters reveals a different trend; these are discussed in the next section as solutions and recommendations.

SOLUTIONS AND RECOMMENDATIONS

Recommendations are organized following the identified trends in supply chain digitalization that emerged from the cluster analysis.

Trend 1 – AI to Improve Quality and Efficiency of Supply Chain Management, Improve Human Decision-making Processes, and Increase Productivity

The adoption and diffusion of big data are at the base of AI and sophisticated optimization techniques applied to address supply chain issues. They are core topics in an emerging stream of research on the effects of new digital technologies on supply chain management. Digital technologies enhance real-time visibility along the supply chain and offer novel approaches to planning and decision making (Rezaei

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et al., 2017) and problem solving, and identify find optimal or exact solutions which otherwise would be too expensive or too difficult. AI was developed to create "thinking machines" capable of mimicking, learning, and replacing human intelligence. Since the late 1900s, AI has shown huge potential for improving human decision-making processes in the area of supply chain management. Over the years, different areas, techniques, and optimization methods have been reviewed to address the complexities of supply chain management, for example, selection of the optimal order-picking path in a warehouse, or synchronization of the different stages of joint demand planning and forecasting processes in the supply chain. At the same time, innovations in distribution channels (Zhang et al., 2016) and environmental concerns (Tiwari et al., 2015; Sadrnia et al., 2013) are triggering research on optimization to increase computational capabilities. In particular, AI (Tsadikovich et al., 2010), and evolutionary and swarm-based (Wang et al., 2019; Wong and Moin, 2014; Zhao et al., 2012; Wong et al., 2009; Sadrnia et al., 2013; Utama et al., 2011) multi-objective algorithms are being used increasingly to support supply chain optimization and decisions (Xin, 2011). The ability to manage ever more complex optimization algorithms is extending current techniques. This work is allowing new levels of supply chain coordination performance based on multi-agent systems (Jain and Benyoucef, 2008; Taniguchi et al., 2005; Wong and Fang, 2010) where agents' behaviors or their optimization are based on AI and its different declinations (Zair et al., 2019). AI (Zair et al., 2019; Zhanguo et al., 2019; Rezaei et al., 2018; Rezaei et al., 2017; Tsadikovich et al., 2010; Taniguci and Terano, 2004) and neural networks (Wu et al., 2008) are at the forefront of emerging trends in supply chain optimization. Each of the studies identified proposes a more efficient solution than the previous one. This process spanned all the periods identified and provides clear evidence that AI supply chain solutions have a positive effect on strategic value creation. In agile supply chain management, AI can influence both value creation and competitive advantage (efficiency, creativity, and flexibility).

Trend 2 – Digitization, Digitalization and Big Data are the Drivers of Supply Chain Agility and Business Resilience to Risk

Digitization, digitalization, and big data are essential for the capacity for firms to grow. They rely on big data to find new ways to innovate to achieve business advantage. In the last period of evolution of digitalization of the supply chain, the most important research focuses on the role of big data. This period focuses on scientific research, empirical contributions, state of the art literature, and research opportunities and directions for big data analytics. This stream of work is aimed at providing a comprehensive understanding of the current state of the art by highlighting theories (Saggi et al., 2018), influencing factors, and the challenges related to using big data.

First, it shows that big data terminology refers more to data collection than data management and data utilization, and to logistics, services, and planning processes more than sourcing, manufacturing, and returns (Brinch, 2018b; Lai et al., 2018). Second, digitalization (Gravili et al., 2018), big data applied to supply chain management, and industry 4.0 (Ding, 2018) are motivated by the need to improve business processes and decision-making practices (Brinch, 2018a). These enhancements provided by use of big data have an impact on business growth (De Camargo Fiorini et al., 2018). An understanding of contemporary applications of big data, and predictive analytics capability are essential (Dubey et al., 2018 a,b,c). Big data and predictive analytics as organizational capability can improve both visibility and coordination in supply chains (Dubey et al., 2018). Investigating the influence of big data analytics on organizations' dynamic capacities (Dubey et al., 2018a,b,c) and personnel expertise provides an under-

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standing of how supply chains develop and the level of their agility (Mandal, 2018). Firms can develop business risk resilience to supply chain disruptions, by developing big data analytics capabilities within their organization (Singh et al., 2019). Research on resilience to risk uses various methodologies: literature review (Brinch, 2018a,b; Gravili et al., 2018), bibliometric studies (Arunachalam et al., 2018), quantitative studies (structural equation modeling) (Wei et al., 2019), smart PLS software (Lai et al., 2018), survey data (Dubey et al., 2019a,b), and Delphi (Brinch, 2018a,b). In forecasting future implementations of big data analytics to manager different supply chain aspects, the authors emphasize a systemic approach to analysis of digitalization rather than a focus only on big data. Smart enterprise business leaders could capitalize on new business and optimization opportunities provided by digital transformation, and new technologies such as cloud computing, mobile phones, big data, and social networks. These innovative technologies are used in combination in co-innovation and co-evolution processes.

Trend 3 –Industry 4.0 Technologies are Enabling Smart Manufacturing in a Global Context

This refers to digitalization based on technologies applied to manufacturing. Companies can be made smarter by the implementation of certain technology which allows them to be more competitive and to better manage the manufacturing process: "*The internet of things, IOT, phenomenon, being a part of a digital revolution, is currently considered as a quite profitable factor for industries and the markets worldwide*" (Shah and Ververi, 2018, p. 160). "*Smart manufacturing has been considered as a successful advancement in industrial revolution featuring resource efficiency, adaptability, agitability*" (Menon et al., 2018, p. 1). Smart manufacturing is underpinned by a range emerging technology. For example, Mandolla et al., (2019) and Mushtaq and Haq (2019) study blockchain technology while Attaran (2017), Tuptuk and Hailes (2017) and Majeed and Rupasinghe (2017) are interested in the IoT, and especially 3-D printing and RFID (Radio Frequency IDentification). Their findings underline that digital technologies improve and optimize manufacturing processes, for example by reducing manufacturing lead times substantially, improving inventory management, reducing stock out, and automating processes. They are allowing faster satisfaction of customer demand (Attaran, 2017). The research in this stream highlights how digital technologies can contribute to increasing traceability, tracking, and real-time visibility. Majeed and Rupasinghe (2017) identify several obstacles including cost of implementation, privacy concerns, security concerns, technical issues, and lack of global standards. Rahman and Rahim (2018) underline the limitations of cloud-based solutions while Tuptuk and Hailes (2017) argue that security in smart manufacturing is receiving too little attention relative to the issue of functionality. There is a risk that these systems could be highly vulnerable to attacks. This is because manufacturing data generally come from the variety of sources: manufacturing resources data (equipment, material and product, environmental), manufacturing information systems (e.g. enterprise resource planning, customer relations management, supply chain management, etc.), computer aided systems, and internet data, (user data collected from the ecommerce platforms and social networking platforms, and publicly available published on open websites). As the complexity of the manufacturing process increases it becomes more difficult to identify the visible and invisible problems arising in the manufacturing process using traditional methods. Big data and digital twins allow for greater efficiency, intelligence, and better insights in manufacturing. They allow correlation and dynamic adjustment among manufacturing planning and implementation, prediction, diagnosis, and maintenance, and the collection and analysis of large amounts

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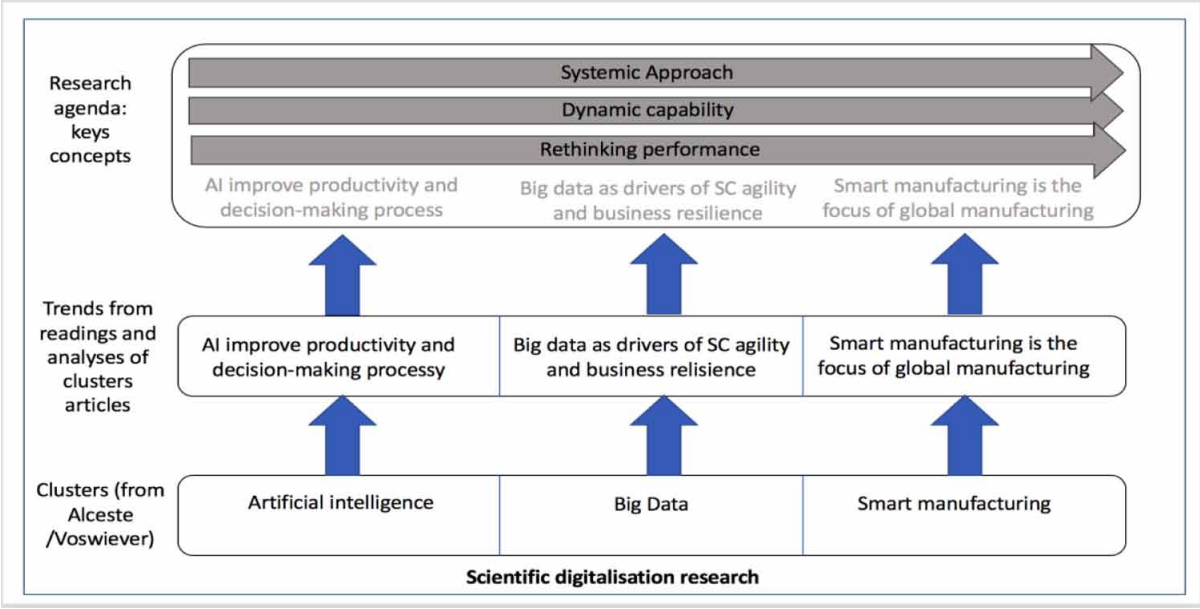
of manufacturing data. They allow companies to develop greater resilience and robustness and achieve better performance outcomes.

Content analysis highlights that big data analytics and supply chains are attractive research topics and involve the study of the opportunities, challenges, and value provided by this new phenomenon. The increasing availability of data stemming from the digitization of products and processes is resulting in data-rich supply chains. These data provide more flexibility and resilience and allow different measures of performance of supply chains and the competencies needed to manage them.

FUTURE RESEARCH DIRECTIONS

The analyses performed showed common conceptual orientations in all the studies analyzed. Bibliometric analysis provided an overview of how the field is developing and identified the main trends (see figure 7) (answer to research question 3).

Figure 7. Synthesis and agenda



Based on our analyses, we propose three directions for future research:

Research Track 1: A Systemic Approach to Analysis of Supply Chain Digitalization

The empirical research referred to in the results and trends sections, identify the core transformative forces underlying supply chain digital transformation. AI, big data, and smart manufacturing are key to supply chain digitalization.

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However, they are addressed by different bodies of knowledge resulting in decisions about supply chain dynamics, control, and disruption separated from planning and expert knowledge. There needs to be a systemic approach to analysis of digitalization of the supply chain rather than a focus on a single innovation. For example, studies of big data constitute a distinct stream of work in contrast to studies of optimization algorithms, for instance, which belong to the computer science and engineering fields. According to the companies' stated objectives, complete digitalization of the supply chain is the first step towards logistics 4.0 which supports industry 4.0. Logistics 4.0 focuses on integrating the most advanced information and communication solutions. The objective is to link people, machines, products, and installations. Global digitalization of logistics operations such as transport, warehousing, inventory planning, supply and return, provides firms with high levels of flexibility and efficiency, making data an invaluable business asset. Big data support firms' competitive advantage and endow power.

This first step should be followed by a second phase which links other digital technologies to allow a move towards a more systemic approach to the supply chain. These digital technologies are discussed in a study conducted by Sorkun (2020) on "Industry 4.0 discourses" and a review of the literature on logistics 4.0 conducted by Winkelhaus and Grosse (2020). These technologies include IoT-based systems, autonomous cyber-physical and robotic solutions, big data applications, cloud systems, mobile systems, and social media-based applications

In logistics, digitalization and analysis of big data are used to optimize, control, and predict the behavior of systems, for example through "business spheres"[1] which facilitate dynamic decision-making (Bughin, 2017). Business spheres allow real-time visualization of massive data (on manufacturing, quality, stock levels, distribution, sales, trends, relationships with suppliers and customers). These integrated models require end-to-end digitization of organizational and interorganizational processes and activities. Furthermore, networking all of the actors involved ensures system interoperability and real time communication. Therefore, in both the technological and business ecosystems, partnerships are critical assets and need to be considered jointly (with BOI, Cisco, HP, SAP, Nielsen and TIBCO Spotfire).

Disruptive technologies based on massive data and their exploitation, can allow synergies with other technologies to create an environment conducive to their intra- and inter-organizational diffusion. Cyber-physical production systems are a cornerstone of industry 4.0 and enable smart factories to operate autonomously. In conjunction with the physical system, a digital twin of the system is created to anticipate risks and uncertainties in the environment in real time (Tjahjono et al., 2017). The cyber-physical system does not stop at the borders of the plant, it interconnects with suppliers' logistics flow monitoring systems. The IoT feeds networks of machines in smart factories and external relations. It allows autonomous exchanges of production, manufacturing, and distribution information. The IoT has changed the organization of production patterns both inside and outside the factory quite substantially. New digital technologies, combined with 3D printing, are configuring manufacturing circuits, interactions between customer demands, design, and manufacturing in different ways. Real-time manufacturing is becoming part of the customer experience. In a systemic approach, each digital technology combines its information with the information from other technologies, to achieve a global understanding within the business ecosystem. Interconnected supply chains and production systems based on AI and big data will require a systemic approach. Innovations in different areas will be able to be combined to provide novel capabilities and business opportunities that will require a multi-disciplinary approach.

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Research Track 2: Digitalization Leads to a Rethinking of Performance

Logistics 4.0 fundamentally changes business performance and challenges the industrial and technological patterns of the 3rd industrial revolution. Digitalization is leading to a rethinking of performance. According to Tang and Veelenturf (2019) logistics has become a profit center rather than a cost center. Logistics and the associated resources constitute a strategic tool which enables companies to compete on speed (delivery services conducted by drones or delivery robots), reliability (storage and retrieval systems using robots), cost (inventory monitoring and replenishment systems using smart sensors), and efficiency (container shipping enabled by blockchain). Factory 4.0 control systems are moving away from a vertical, centralized structure to a resilient approach with smart technologies at the center of all processes. However, these smart technologies can only be developed and sustained by the capacities and skills of the different actors involved.

The strategy of cost reduction through outsourcing and offshoring to countries with low labor costs is being challenged by the new division of labor. Personalization, real-time manufacturing, and distribution of products within the hour have become major sources of differentiation and value creation. In this context, a review of the literature on the impact of Industry 4.0 on supply chain management performance, conducted by Tjahjono et al (2017), provides some useful leads. Performance is measured in terms of opportunities or threats for the four pillars of supply chain management: procurement, warehousing, fulfilment process, and transport logistics. The results show that the most positively impacted, by more than 50% by industry 4.0, are order processing and transport logistics. This is due to the implementation of technologies such as virtual and augmented reality, 3D printing, and simulation.

However, some technologies generate both opportunities and threats for instance big data analytics, cloud technology, cybersecurity, IoT, miniaturization of electronics, drones, etc. Business performance undeniably depends more and more on the quality of the interactions among economic actors within and outside the value chain, that is, the quality of the business ecosystem. *« Many digital technologies are needed to achieve this goal, and these technologies should assure interoperability between diverse information technology (IT) systems to minimize implementation costs and time for information processing» (*Ardito et al., 2019, p. 5). Industry 4.0 stimulates digitization so that all data related to inbound and outbound logistics operations, market needs, and product-customer interactions are available in real time. The paradox is that digitalization contributes to increased industrialization while simultaneously disrupting the sustainability of industrial systems. From an ecological point of view, logistics 4.0 has a role to play in the sustainable orientation and performance of companies (Tjahjono et al., 2017). According to Luthra and Mangla (2018), innovative technologies (robots, cobots, RFID, IoT, 3D printing, etc.) can help companies develop environmental protection and control initiatives (data quality and credibility, environmental impacts, etc.). They also contribute to the implementation of sustainable supply chains (real-time monitoring and control of production, energy consumption, material flows, pollution rates, and optimal use of resources, technologies, etc.). However, according to Doussou (2018) this role is likely to be limited to large companies capable of acquiring these new technologies (robots, cobots, RFID, IoT, etc.), and will exclude small and medium sized firms due to the many organizational, legal and ethical, strategic and technological challenges they would face (Luthra and Mangla, 2018).

Thus, a systemic approach is appropriate for understanding the complexity of the supply chain and highlighting value creation and performance (track 1)

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Research Track 3 – Beyond Innovative Digitalization Technologies, Dynamic Capabilities are at the Core of Performance and a Systems Approach

The analysis of the results confirms the strategic importance of digitalization. At the same time, the emerging model appears to be based on a systemic view, analysis and exploitation of value creation. Digitalization is giving rise to new forms of increasingly strategic cooperation. Therefore, assuming that digitization is a strategic resource, the current resource and capabilities theories should be developed integrating both the interorganizational and systemic views. Several studies integrate the concept of Valuable, Rare, Inimitable and Non-Substitutable or VRIN resources to explain the different competitive capacities of firms. In these studies, information systems resources and skills affect the firm's overall performance and its ability to maintain competitive advantage (Santhanam and Hartono, 2003; Wade and Hulland, 2004; Pavlou and El Sawy, 2006). Similarly, supply chain resilience and robustness built on digitization, are identified as important source of organizational performance (Brandon-Jones et al., 2014). Resilience relates to "*the concept of an organization being able to rapidly bounce back from the effects of a disruption, while robustness refers to an organization's ability to maintain functionality despite disruption*" (Brandon-Jones et al., 2014). Rather than a simple organizational capability, resilience represents a collective adaptive capability among the organizations in the supply chain network. Resilience relates to maintaining a dynamic equilibrium to react to and recover from a disruptive event, and to regain performance by absorbing negative effects, responding to unexpected changes, and capitalizing on successes and failures (Yao, 2014). To absorb and recover from shocks and disruptions due to the crisis, digitalization is essential It provides a maximum amount of reliable information in real time that can be synchronized with the various partners (Hohenstein et al., 2015). It facilitates the management of the activity according to numerous parameters and allows simulations to be carried out in order to anticipate the risks. Beyond data collection or investment in digital technologies, digitalization requires the coordination of specific bundles of internal and external resources and capabilities (Barney, 1991; Hoopes et al., 2003; Rumelt, 1984).

What is important is that digitalization encompasses clear strategic characteristics supporting both cost and differentiation strategies. More specifically, while the technical capacity to leverage digital data is widely available in the market, mastery and processing of contextual information is a rare and specific skill which limits its imitability. Interestingly, the context-specificity demanded by digitalization makes the emerging configurations and networks difficult to substitute.

In this sense, digitalization appears to be an increasingly strategic dynamic capability (Teece, 1997) originating at the individual level and manifesting at the organizational level. In the case of digitalization, we believe the individual level plays a critical role because the strategic capacity translates into mastery of and processing and analysis of big data. In contexts where increasing amounts of digital data are generated, professional expertise is scarce which is creating a (yet to be explored) tension between the individual and organizational layers that could be an interesting avenue of inquiry.

More generally, the existing research supports and justifies the legitimate interest of industry in digitally-enabled strategic initiatives and related investments. In competitive terms, our results suggest that organizations should continue to explore the impacts of AI -based techniques on their supply chains or risk losing competitiveness to more pioneering adopters. However, more research is needed to understand the sustainability of competitive advantage built on digitalization, and what might prevent its erosion by competitors. This finding has implications for both academics and practitioners. Researchers should continue to analyze the phenomena and their impacts and opportunities. This will require the research

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scope to extend beyond single disciplines. Supply chain-wide impacts originating from new algorithms, and the difficulties related to autonomous AI -based systems will require new research competencies.

CONCLUSION

Our research contributes to the literature on digitization of the supply chain and extends and enriches the findings from systematic literature reviews (such as Tiwari et al. (2015), Nguyen et al. (2018) and others), and offers a more fine-grained analysis than previous bibliometric approaches. Use of the Alceste software allowed lexical analysis of paper abstracts and a detailed analysis of the most significant articles.

The body of academic research on supply chain digitalization is recent (2018-2019) and is published in journals focused on different areas (business, management, decision sciences, economics, computer science, engineering and environmental sciences) and authored by a structured and identifiable community. These works focus on successful supply chain management which relies on AI, big data, and coordinated decision making across logistics networks in a sustainable environment.

The main topics addressed in the literature fall into three groups: digitalization and big data, smart manufacturing digital technologies and AI, and supply chain optimization techniques. More research is needed on the contributions of these new tools, how they affect established strategic supply chain capabilities, and the impact of AI on supply chains.

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ENDNOTE

[1] https://www.pg.com/en_US/downloads/innovation/factsheet_BusinessSphere.pdf

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APPENDIX A: BIBLIOMETRIC POSITION

A= Period of analyse B= Number of articles studied C= Software used in bibliometric analysis Articles	A	B	C
1. Ardito, L., Scuotto, V., Del Giudice, M., & Messeni, A. (2018). A bibliometric analysis of research on Big Data analytics for business and management. Management Decision.	2012-2018	478	VOSviewer
2. Aykroyd, R. G., Leiva, V., & Ruggeri, F. (2019). Recent developments of control charts, identification of big data sources and future trends of current research. Technological Forecasting and Social Change, 144, 221-232.	2015-2016	400	Bibexcel
3. Cobo, M. J., Jürgens, B., Herrero-Solana, V., Martínez, M. A., & Herrera-Viedma, E. (2018). Industry 4.0: a perspective based on bibliometric analysis. Procedia Computer Science, 139, 364-371	2013-2017	333	SciMAT
4. de Oliveira, A. O., Oliveira, H. L. S., Gomes, C. F. S., & Ribeiro, P. C. C. (2019). Quantitative analysis of RFID' publications from 2006 to 2016. International Journal of Information Management, 48, 185-192.	2006-2016	20 239	VOSviewer
5. Li, M., Porter, A. L., & Suominen, A. (2018). Insights into relationships between disruptive technology/innovation and emerging technology: A bibliometric perspective. Technological Forecasting and Social Change, 129, 285-296.	1999- 2015	1607	CiteSpace
6. Liang, T.-P., & Liu, Y.-H. (2018). Research Landscape of Business Intelligence and Big Data analytics: A bibliometrics study. Expert Systems with Applications, 111, 2-10.	1990-2017	11 946	CiteSpace VOSViewer
7. Mishra, D., Gunasekaran, A., Papadopoulos, T., & Childe, S. J. (2018). Big Data and supply chain management: a review and bibliometric analysis. Annals of Operations Research, 270(1/2), 313-336.	2006-2016	286	BibExcel and Gephi.
8. Muhuri, P. K., Shukla, A. K., & Abraham, A. (2019). Industry 4.0: A bibliometric analysis and detailed overview. Engineering Applications of Artificial Intelligence, 78, 218-235.	2012-2017	1619	VOSViewer
9. Muñoz-Villamizar, A., Solano, E., Quintero-Araujo, C., & Santos, J. (2019). Sustainability and digitalisation in supply chains: A bibliometric analysis. Uncertain Supply Chain Management, 7(4), 703-712.	2002-2018	484	VOSViewer
10. Rialti, R., Marzi, G., Ciappei, C., & Busso, D. (2019). Big data and dynamic capabilities: a bibliometric analysis and systematic literature review. Management Decision.	2007-2017	170	VOSViewer
11. Seyedghorban, Z., Tahernejad, H., Meriton, R., & Graham, G. (2020). Supply chain digitalisation: past, present and future. Production Planning & Control, 31(2-3), 96-114.	1984 - 2018	331	CiteSpace
12. Trotta, D., & Garengo, P. (2018, March). Industry 4.0 key research topics: A bibliometric review. In 2018 7th international conference on industrial technology and management (ICITM) (pp. 113-117). IEEE.	not mentioned	107	VOSViewer
Our article Bibliometric analysis of the supply chain digitalisation	1995-2019	638	VOSViewer Alceste

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APPENDIX B: RESEARCH PROTOCOL

Selection and collect of data		
Filter Type	**Description**	**Number of articles**
Period	Since the first academic publication on the topic 1995 to August 2020	
Language	English	
Step 1 – Databases	Selection of 3 databases: Business Source Complete, Science Direct, Scopus	4554
Step 2 – Choice of keywords	Selection of 2 keywords: “digital*” “supply chain”,	
Step 3 – Additional keywords	Selection of 5 keywords coupled with the additional keyword: “IOT”, “technolog*, “4.0”, “big data analytics”, “artificial intelligence”	
Step 4 – Type of publication	Restricted to peer review academic articles and annual meetings	
Step 5 – Nature of the content of publications	Any keywords indicating empirical data or theoretical analysis in their title or abstract	
Step 6 – Editorial choices	No filter	
Step 7 – Coherence	Elimination of duplicate articles	- 1816 = 2738
Step 8 – Verification	Reading abstracts for substantive relevance	
Step 9 – Consolidation	Reading full articles for substantive relevance	
Total		**638**
Executing of bibliometric research protocol		
The results are exported to the Endnote bibliography software The resulting database is analysed using Vosviewer and Alceste software		

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APPENDIX C: DISTRIBUTION OF AUTHORS

Appendix C.1. Distribution of articles by author numbers			**Appendix C-2. Number of authors who have published several articles**			**Appendix C-3. Most Published Authors from the database**		
Nb of authors per article	**Quantity**		**Nb of Authors**	**Nb of articles**		**Authors**	**Documents**	
1 author	88		102	2 articles		Gunasekaran, Angappa	16	
2 authors	158		21	3 articles		Dubey, Rameshwar	8	
3 authors	164		11	4 articles		Papadopoulos, Thanos	9	
4 authors	142		4	5 articles		Child, Stephen	6	
5 authors	45		3	6 articles		Fosso-Wamba, Samuel	6	
6 authors	25		1	8 articles		Choy, K. L	5	
7 authors	11		1	9 articles		Hazen, Benjamin	5	
8 authors	2		1	16 articles		Zhang, H	5	
10 authors	1					Zhang, Y	5	
12 authors	1					Zhong, Ray	6	
36 authors	1							

APPENDIX D: AUTHORS CITED

Authors widely cited in bibliographies for different articles, more than 40 articles

Ivanov	119
Sokolov	95
Wamba	92
Dolgui	74
Darigo	64
Akters	54
Lee, H.L	52
Davenport	46
Lee, J.	42
Yan, J	43
Disney	40
Dubrey	40
Zhong, R	40

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Chapter 24
Digital Journalism and Transmedia Narratives in the Communication of Science: From Disruption to Reinvention

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ABSTRACT

Knowing what the best channels of information are in the digital ecosystem has become a great challenge for science journalism, especially in pandemic times and where social networks have given rise to greater dissemination and immediacy. New processes are constantly appearing that are reinventing the profession through disruptive actions, such as communication via transmedia narratives. This chapter presents an approach on how journalism has been developed in the digital age and, in particular, how science journalism is incorporating technologies, narratives, and formats to project its content. From here, an analysis model is proposed for evaluating the degree of transmedia innovation and evolution in science journalism, along with a number of guidelines and recommendations for implementation.

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INTRODUCTION

The health crisis that the world is going through due to the coronavirus pandemic has brought to the fore that in order to guarantee a good information diet, taking an interest in science and technology is essential for society. The science communication developed by both institutions and scientists and specialist journalists who work in the field, has gained a fundamental relevance in the fight against the virus and the disinformation that has been generated as a result thereof. This communication is evidently no longer the exclusive domain of traditional media formats, rather, it has exploited current technological and digital advances in order to reach a greater number of people. In this way, diverse channels are used in order to achieve one of its main objectives, namely, to provide people with rigorous and reliable information.

Nevertheless, it is not an easy road. In effect, the proliferation of fake news and the numerous stimuli that citizens now receive means on many occasions that the true message fails to reach all audiences, or is lost in the digital ecosystem. Knowing the best way to effectively share information is an arduous task. This is even more the case considering this review are speaking about a digitally revolutionised world, which seeks out channels in the most disruptive elements in order to effectively disseminate and promote scientific knowledge.

This chapter deals with the phenomenon of digital transformation experiences in the sphere of scientific journalism and the use of new interactive formats. In this way, there will be a description of the evolution of digital journalism, the incorporation of transmedia narratives on a daily basis and how scientific journalism forms part of this trend. The analysis of the current situation permits us to envisage the future of scientific journalism in digital environments, and discover the appropriate exercise of the profession and its impact on audiences, ever more fragmented into their own interests (Denia, 2020).

The work is based on a systemised bibliographical review regarding the concepts addressed here (Codina, 2020). Thus, the study respond to the following research questions using the analysis of the specialist literature:

Q1. To what extent and in what way have digital journalism and transmedia narratives collaborated in the exercise of science journalism?
Q2. What use does journalism make of disruptive elements such as social networks and transmedia narratives, and to what degree have these collaborated towards its development?
Q3. How have these digital aspects contributed to the reinvention of science journalism?
Q4. Which elements should be considered in order for transmedia narratives to be effectively applied in science journalism?

The general objective of this study is focused on identifying the role of certain elements of digital journalism, specifically transmedia narratives and social networks, in the communication of science information, and in proposing essential strategies that enable the application of these disruptive elements in the development of science journalism.

The investigation carried out to address this systematic review included the undertaking of bibliographical queries aimed at locating specialist literature focused on the main concepts tackled in this work (García-Marin, 2021)

1. It´s began to put queries to the most prestigious and reputable multidisciplinary bibliographical databases, Web of Science and Scopus. Relevant information was also extracted from the very

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popular Google Scholar. In addition, specific institutional websites were accessed that served as a source in a number of more general aspects.

2. The queries were limited to publications comprising the chronological period from the year 2015. In this way, there was also the inclusion of articles accepted in scientific journals and available online, even though the definitive publication had not been produced. However, this investigation has also considered publications of reference that have appeared in previous years, but which offer a fundamental contribution to adequately configure the state of the art of this topic.
3. The queries were made in both English and Spanish in the title, abstract and keywords search fields. The different search strings included the terms "digital journalism", "social networks", "transmedia narratives" and "science journalism", combined in different ways in order to guarantee an exhaustive recovery of documents.
4. In the subsequent review of the recovered results documents such as undergraduate and master's dissertations were excluded, along with articles originating from non-indexed journals or those in which the details of their authors did not correspond to universities or scientific centres that supported them.
5. Then proceeded to analyse the publications. To do so those parts and aspects of the texts related to our research questions were highlighted.
6. Finally, an editorial plan was developed that summarised the most noteworthy and frequent concept, related to transmedia narratives and social networks, present in science journalism according to the specialist literature analysed.

Following this, firstly a general panorama is presented on digital journalism, its main characteristics and how social networks and transmedia narratives have arisen as strategies for developing science journalism. The second section contains a systematic review of the aforementioned concepts, there limitations and complications, and how each of them is complemented.

Afterwards there follows the presentation of recommendations for using transmedia narratives in the exercise of science journalism, to then reveal the limitations of this study, the future that this type of investigation may have, and the general conclusions drawn from it.

BACKGROUND

In recent years journalism has undoubtedly come to be a completely digital profession –beyond the fact that in some aspects it maintains actions and strategies that are analogue in nature– (Salaverría, 2021). This is why, despite retaining the foundations of traditional journalistic practice, with very similar genres and styles (Moreno-Espinosa, 2017), the focus of its professional activity has translated into interaction, citizen participation, and pursuing a greater reach and crossover of the media (Arcilla Calderón et al., 2021).

Technological progress, together with the skills it forges, has therefore changed the way in which the media industry faces its day to day challenges (Salaverría, 2019). Furthermore, this analogue to digital transition, with all of the social, economic and political challenges it brings (Mesquita & Fernandes, 2021), has had a definitive influence on the daily tasks of journalists.

One of the aspects to have fostered this change is the appearance of the social networks; platforms that have revolutionised the information ecosystem and the way in which news is produced (Benaissa

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Pedriza, 2018). Journalists have inevitably incorporated these applications into their professional lives, transforming themselves into a channel and source of information (Mellado & Alfaro, 2020), which seeks high levels of user loyalty, to thus create bonds and complement mutual needs in this digital world (Zurita Andión, 2019).

In this context, journalism, and the media in particular, have entered a period that can be referred to as disruptive, given there is a moving away from tradition and classic formats, and news becomes not just an informative resource, it also seeks to increase interaction and access to content on the part of potential readers (Trillo-Domínguez & Alberich-Pascual, 2020). In this digital transformation journalism is undergoing, transmedia narratives have developed a significant prominence.

Put simply, transmedia narratives can be understood as the systematic dispersing and diversification of narrative elements in such a way that news stories are told via multiple platforms, using all convenient channels, in order to create a unique experience (Scolari, 2009; Jenkins, 2010). What is sought, moreover, is to build loyalty amongst users by making them active participants in this type of story (Chomón-Serna & Busto-Salinas, 2018).

It is true that journalism has always showed a tendency towards transmedia in some way or another. This fact is easily demonstrated if taken into account the transfer of information that has taken place from the printed press to television, and the participation of readers and listeners, who have always addressed a newspaper to complain about something or interact by calling the radio (Scolari, 2014) which has traditionally facilitated the expansion and enrichment of the original news story.

In the modern age, the multimedia job, the inclusion of the user with a more participative role, the transmission of content via social networks, and the use of virtual reality to present news (Costa-Sánchez et al., 2019), form part of the experiences that are being incorporated into all newsrooms, and there is an increasing search for journalists with this emerging profile, which involves extensive capacities for producing and disseminating content (Sánchez et al., 2019).

In this context, as expected, scientific journalism and the communication of science have not remained unaffected by these changes. The Internet and Web 2.0 tools have been excellent channels for attracting audiences interested in scientific content (Harmatiy, 2021). This has led to the point where journalists, especially those who work in this area, must acquire skills and continuously improve in terms of how to write about these topics, endeavouring to adequately divulge specialised information (Calvo Rubio & Ufarte-Ruiz, 2021).

The communications media and, therefore, journalists, have gradually ended up having to reinvent themselves by implementing digital strategies in their professional lives, with the effective adoption of transmedia tools for favouring the comprehension of news (González-Pedraz & Campos-Domínguez, 2017) and, in the case of scientific news, the growing inclusion of aspects such as hypertextuality, interactivity with the public and writers, or multimediality via videos and infographics (Martin-Neira et al., 2022).

The application of transmedia actions to science does not just occur from a computer or digital newspaper. In contrast, the audio-visual genre has begun to adopt certain elements that include user participation and opinion, which has fostered a greater comprehension of contents on the part of audiences when accessing and consuming certain scientific documents (Christin, 2018). Science podcasts also help to promote and expand stories amongst the public (De Lara-González & Del Campo-Cañizares, 2018) and even the use of TED (*Technology, Entertainment, Design*) talks, which mix dissemination with humorous components (Vizcaíno-Verdú et al., 2020), are being distributed as part of transmedia strategies.

Scientific journalism currently faces great challenges. Not only must it fulfil its traditional responsibility of evaluating, understanding and explaining what is happening with science (Calvo-Hernando,

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2002), living in a world submerged in the coronavirus pandemic has increased audiences' desire to know even more about the discipline of science (Fürst, 2021) and, through it, the capacity of reinvention to communicate it needs to be extremely high, taking into all of the digital elements into account.

This is where there is a big opportunity with modern tools. Despite the internet having become an essential platform for scientific communication (Sanz-Lorente & Guardiola-Wanden-Berghe, 2019) and efficient dissemination has been achieved from *Instagram* to *TikTok* (Habibi & Salim, 2021), there is still more to do. The challenge of connecting with and gaining the loyalty of audiences that, thanks to the new technologies feel part of a collaborative community (Gosciola et al., 2019) is key, and further discovery of the possibilities offered by the transmedia narrative as a viable alternative for transmitting messages and building knowledge (Villegas Carmona, 2020) forms part of this challenge.

MAIN FOCUS OF THE CHAPTER

Issues, Controversies, Problems: The Challenge of the Digital Revolution in Scientific Dissemination

The concept of digital journalism is not new. For over two decades numerous experts have endeavoured to explain how this technological transformation has been confronted, which has had an influence on both the media and professionals alike (Salaverría, 2009; Zamora, 2009; Cobo, 2012). This is how elements such as interactivity, versatility and multiplicity have slowly but surely become incorporated into daily language (Caminos Marcet et al., 2007) and both journalists and consumers of news have gradually accepted their presence.

In this adaptation process, by assuming that technology had come to stay in journalism, the profession began to live digitally, to take advantage of the technology to capture and transmit information, resulting in an organisational and productive transformation in the media (Reyna García, 2021). Moreover, for some researchers such a differentiation no longer exists; that is, digital journalism is simply journalism (Perreault & Ferrucci, 2020).

Beyond the fact that this digital revolution includes new practices, a new treatment of audiences and new financial strategies, the central value of journalism has not changed (Mesquita & Fernandes, 2021). In other words, there is a search for new channels of communication, there is a much higher consideration of audiences, interactivity is fostered in different formats, amongst other characteristics, but information continues to be the most important and credibility is transcendental, to which there is no room for fake news and ethics is presented as fundamental in the exercise of the profession (Moreno-Espinosa, 2017; Ulpo et al., 2020). In this way, it´s possible to say that the evolution of digital journalism has been constant. In fact, it has opened the doors to topics that were not generally covered in the traditional media, and has contributed to being the voice of citizens who often lacked representation (Duffy & Ang, 2019). The appearance of blogs, for example, enabled cost free, wide reaching communication, and in which the users were the main creators of the content published; This is reflected, for example, in the fact that in the year 2000 there were around 4000 digital media in the world, meanwhile in 2018 only in Spain there were 3000 existing media (Salaverría, 2019).

Nevertheless, and despite the achievements and progress in the matter, the beginnings were far from easy. On the one hand, there were no minimum conditions for professionals to be able to carry out digital communication (Calvo Bermejo, 2005) with newsrooms that lacked the tools necessary for tackling the

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challenges of the new work in the digital environment. On the other hand, there was a reluctance amongst journalists to adapt to these changes, and they often remained immersed in traditional routines (Gómez-Escalonilla Moreno, 2004). Furthermore, and equally importantly, there was never a proper definition of how to do journalism from printed mediums and communicate digitally at the same time (O'Sullivan & Heinonen, 2008), to which formats have undergone constant changes. This is fundamental, because concepts such as hypertextuality and hyperlinks, to mention a few examples, continue to be elements that have not been completely resolved in the media, with differences still being found as regards how to communicate a news story in these types of format compared to printed versions (Fondevila-Gascón & Segura Jímenez, 2012).

At present, digital journalism faces two large obstacles, amongst many other additional risks. Firstly, there is the fight against disinformation and the generation of fake news, two battles that have reinforced the role of the journalist as an information professional (López-Borrull et al., 2018), and have created an excellent opportunity for carrying out rigorous, contrasted and verified journalism (Anselmo-Villanueva et al., 2021). It is undoubtable that Covid-19 has given rise not just to problems relating to health, but also information (World Health Organization, 2020). In the face of this, journalism has joined the fight against disinformation and the proliferation of fake news, constantly looking to verify data that arises (Noain-Sánchez, 2021; Pérez Curiel, 2021), and, in turn, better know its audiences and the channels they choose to get their information from. It is worth pointing out that, at present, only 36% of Spanish citizens trust the media (Pérez Escoda & Pedrero Esteban, 2021).

The second problem that digital journalism faces is that of being able to identify which channels are the most appropriate for communicating, to on the one hand obtain better financing and on the other awaken readers' interest (Morejón Vallejo & Zamora Pérez, 2019). On this plane creativity is essential for forging new possibilities (Witschge et al., 2019), making it necessary to explore in-depth how to make good use of existing tools and technologies.

The Social Networks Come into Play

The two aspects mentioned, fake news and the search for new channels to communicate a news story, share a common element, the social networks. The evolution of the mobile phone, and social media platforms in particular (Marta-Lazo et al., 2020), have marked the development of journalism in recent years, and have become a fundamental tool for being informed.

This is not all; the social networks have changed the way in which humans relate to each other and communicate (Calleja-Reina et al., 2018) becoming the main tool for interaction that society currently have, where half of the population has a social media profile and spends more than two hours a day using one of them (Calcaneo Monts, 2021). Moreover, the lockdown caused by the pandemic has driven the proliferation of actions created via these communication platforms (Aleixandre-Benavent et al., 2020; Ferrer-Serrano et al., 2020; Rodríguez-Martínez & Arango Lozano, 2021; Li et al., 2021). In this way, there are an increasing number of activities that are being transferred to the digital realm (Aguilera & Casero-Ripolles, 2018), hence affording importance to the possibility of being connected, immediacy, multimediality and factors that enable interaction with audiences (Marinas, 2019; Fernández Fernández et al., 2021).

Journalism was not removed from these changes and quickly began to adopt certain elements to its news formats. The social networks have acted as a disruptive medium, which has changed the traditional channels of communication in journalism and modified how the profession is exercised (Salaverría,

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2019; Trillo-Domínguez & Alberich-Pascual, 2020). On the one hand, social networks form part of the production of news and, on the other, constitute the information dissemination channel (Escobar & Bahamonde, 2020). This is why no medium wants to be excluded from everything that implies living in a world of social networks (Campos-Freire et al., 2016). Furthermore, these applications have for many citizens come to be their reference news source, overtaking even traditional mediums (Salvat, 2021), which has led to a reassessment of the ways in which news is delivered and the information channels required for reaching audiences. For many people, news shared on social networks even fosters a space for community and interaction that is much greater than for other experiences (Swart et al., 2018).

One of the fundamental aspects to arise when integrating social networks into journalistic practices is the importance given to the relationship with audiences. The public are no longer perceived as passive receivers. In contrast, they also currently constitute active agents who collaborate in content creation (Peña-Fernández et al., 2021). Citizens have had a crucial role in creating information and, thanks to technology, are able to communicate news and broadcast it to everyone, building communities with people who have similar interests (Delgado et al., 2021). Another of the characteristics that can be detected on these platforms is that the news product has no sell-by date, contrary to that which does occur quite frequently after a television news report has been aired, or an article has been published in the newspaper, with this information not usually repeated. In contrast, news continues to live on the internet (López-Meri, 2016) and it is even journalists themselves who revive it when they share what their colleagues do, or what the job entails, strengthening the viral function of social media (Herrero Curiel, 2015).

However, despite the advantages they offer, the relationship with the social networks has not always been positive. Criticism by journalists has been documented regarding the use of social networks as information sources, with attention being drawn to the fact it is always necessary to contrast that which is obtained from this type of channel (Varona-Aramburu & Sánchez-Muñoz, 2016). This aspect is relevant given that, for many authors, sources and their resulting quality are built on elements that are fundamental for good exercise of the profession (Martínez-Fresneda, 2004; Pérez Curiel et al., 2015). Another problem that arises when using these types of applications is determining how to achieve a positive balance between the professional and personal space of the journalist (Mellado & Hermida, 2021). This happens because of the continuous confusion generated on social networks between what constitutes a personal opinion and when the journalist speaks as the voice of the medium where they engage in their profession. Moreover, it can be observed that numerous journalists and mediums fail to employ strategies for promoting their appropriate use (Blanco & Palomo, 2019) and, in contrast, tend to act as content replicators, without contextualising or "critically" evaluating messages (Suárez Villegas & Cruz Álvarez, 2016).

Lewis and Molyneux (2018) have indicated, furthermore, a series of aspects to which attention should be paid in relation to journalism and social networks. In this study, the authors state that journalism with a sense of immediacy is favoured, but forgets its role of checking whether or not what is being communicated is true. This last point also indicates that there is at certain times a belief from journalism that social networks exactly reflect reality and constitute an environment that permits the gathering of "the most varied opinions", when many studies have demonstrated that they are not a faithful representation of the public.

Nevertheless, beyond these valid questions, the social networks have consolidated themselves as a fundamental tool for modern journalism, which is experimenting with diverse channels for communicating information. In this regard a positive development in this evolution relates to transmedia narratives,

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which take advantage of the possibilities of the immediacy, viralization, loyalty and content creation offered by these applications (Renó & Flores, 2018; Zurita Andión, 2019).

Transmedia Narratives as Disruptive Tools

In its simplest definition, transmedia narration arises when a story achieves expansion via different mediums and platforms, thanks to an initial content and another created, in general, by users (Scolari, 2013). It is a concept that has been used for years, as for example in Hollywood movie franchises, but in recent decades it has become widespread due to the convergence that occurs between the multiple platforms that inhabit our social ecosystem and their possibilities for expansion (Jenkins, 2003). Users undoubtedly play a fundamental role in enabling a story to undergo optimal expansion. Guerrero-Pico y Scolari (2016) realise that, as fruits of technology and digitalisation, stories are more manageable and combinable, circulating rapidly thanks to the social networks. This is where user-generated products find their niche and can even, beyond their technical quality, be absorbed by large companies and institutions. Accordingly, a concept that summarises the active user in the creation of stories is that of prosumer, an acronym between producer and consumer and which defines the subject that re-creates content, modifies it and achieves an expansion of the initial story (Moya & Moya, 2018), with a powerful capacity for creating multidirectional flows of content (Christin, 2018).

But not all users show similar behaviour. Can be found audiences who simply view the content, those who are content creators, and even others who become leaders at the moment of disseminating a story (De La Fuente-Prieto et al., 2019). The modern day public are adopting to their different roles at the moment of generating products, delving into the stories or connecting personalities, and thus contributing to the construction of a transmedia narrative world from their own platform and level of interest (Scolari & Establés, 2017).

Starting out from these elements, the media disruption achieved with this type of narrative encourages the different areas of knowledge to explore new paths for communicating and creating content (Jauregui-Caballero & Ortega-Ponce, 2020). These possibilities are those that journalism has begun to apply and use in its working dynamics. In particular, when communicating news, adapting their formats to the multimedia, hypertextual and interactive environment that these narrations generate, thus breaking away from the traditional, and delivering the news story not just as information, but also as an experience (Trillo-Domínguez & Alberich-Pascual, 2020). In this way successful practices of the use of transmedia narratives in journalism have been documented such as, for example, audiovisual pieces associated with Spanish photojournalism in which each journalist was able to give their own view of the events via the images they took, and where readers were also able to contribute their perspectives (Irala Hortal, 2014).

Likewise, also relevant are the experiences of the public television channels in Spain, France, the United Kingdom and Germany, oriented towards integrating transmedia narratives into their programming, extending stories to mobile phones, seeking in this way to connect with younger audiences (Azurmendi, 2018). In turn, transmedia elements are also being applied within corporate or institutional communication to engage in brand positioning, via opinion leaders who reinforce the values they want to communicate and strategies that encourage users to create content with a high viral impact (Mut Camacho & Miquel Segarra, 2019).

Beyond these experiences, diverse journalistic disciplines have experimented with this type of content and have asked themselves if their area of work is appropriate for creating transmedia content and carrying out strong dissemination campaigns via social networks. In this dynamic, science journalism

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has not remained immune to the changes and challenges. On the contrary, the discipline is undergoing a constant reinvention, trying to identify the best channels for communicating elements that assiduously come with a high degree of complexity, abstraction and methodology (Cassany et al., 2018) to which experimentation, both on social networks and using transmedia narratives, has been the tonic in recent years. A question to be asked is, therefore, what strategies has science journalism applied and how has it been developed in this digital revolution?

The Communication of Science and the New Platforms

Science is everywhere. From the time that someone get dressed in the morning, the transportation used to get to work and the associated technological tools. Playing a game of football, cooking lunch or a watching a television programme are common actions that can be seen with a scientific eye and speaking about them can be something very day to day. But, beyond how interesting it can get, it should not be forgotten that science is fundamental for society, its development and the challenges faced by humanity (United Nations Educational, Scientific and Cultural Organization [UNESCO], n.d.).

Frequently lose sight of the importance of science for our daily lives, of the benefits it provides to the population, of the urgent need to be able to communicate the most recent advances in the subject, and its influence on technology, the economy and social development (Calvo-Hernando, 2002). In the face of all of this, it becomes necessary to effectively communicate content, which is why in recent years there has been a resurgence of the discipline, specifically regarding an interest in informing with exactitude, balance and impartiality (Hansen, 2016) and where the quality of science news has increased, encouraging context and understanding of information for audiences (Dunwoody, 2020).

These aspects are particularly necessary for everything related to Covid-19 and the pandemic that has affected the planet, and where there has been an evident need to publish on science and, no less importantly, the fact that it has been necessary for journalistic mediums and structures to transform themselves digitally to face up to this health problem (Carrero & García, 2021;Finneman & Thomas, 2021; Quandt & Wahl-Jorgensen, 2021). The interest generated by health crises translates into the media increasing their publications on the topic (Costa-Sánchez & López-García, 2020), for example, studies such as those by Greene González et al. (2022) show that Spanish citizens seeks information about this topic 78% more than they did previously. People want certainty regarding aspects associated with vaccines and new variants of the virus, to which the consumption of this type of news has increased (Fürst, 2021).

It is important to clarify that science journalism is understood as the social communication of content on science and technology, which is transferred in multiple public directions to communicate the work, advances and other aspects of the discipline (Marcos, 2010). In this context, explanation and dissemination are distinctive factors (Belenguer Jané, 2003), always taking into account those traditional aspects that make up a news story as such, namely, relevance, general interest, and truthfulness (Yanes Mesa, 2003). It is also necessary to highlight the educational role of journalists regarding scientific work, advances and research results, to which it is expected that those who work in the discipline deploy high teaching and analytical capabilities (Vernal-Vilicic, 2015). In this manner they contribute to the audiences being able to acquire the capacity to generate critical opinion on science and technology topics (Olvera-Lobo & López-Pérez, 2015), with the journalist thus acting as a mediator of scientific information more than a translator of these events (Carmona-Jímenez, 2007).

Science journalism, and those who engage in it, has taken advantage of the diverse communication channels that have existed throughout history to achieve its informative objectives. This is how news-

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papers, radio and television were initially the main source for communicating the events that occurred in the world and figures rapidly emerged who, not necessarily being journalists, captivated audiences with subjects of a scientific nature (Vernal-Vilicic, 2015). The appearance of the internet was a revolution in the creation of scientific content, transforming news production, interaction with the public, the verification of information and the way in which the media replicate content (Alonso-González, 2018). Progress in the technology, with the improvements that were made to multimedia aspects and enabling the telling of news stories in a non-linear way, in other words there was construction with diverse narratives and ways of being communicated (Hermida, 2010), were the first changes perceived in media newsrooms. Digitalisation has had an impact on the importance of deciding how and what paths are used to transmit a piece of information, taking into account that this whole process of information and news production contains hypertextual elements, uses the different platforms to reach its audiences and encourage interactivity with readers (Duque & Tejedor, 2020). This way, there is a clamour for identifying the best ways of achieving communication that is more effective and which generates greater dialogue (De Semir, 2010).

However, the process of integrating digital tools into the creation of science news stories in cyber mediums is not yet something used extensively, and there is often a predominance of the exclusive use of text over other multimedia or hypertextual applications, failing to introduce the advantages that digital journalism can lend to news production (Duque & Tejedor, 2020; Martin-Neira et al., 2022)

In addition, as already mentioned, the internet opened the doors for audiences to not only read or see aspects of science, but also became the platform for facilitating communicate both with the scientists and the journalists who work in the area, changing narrative dynamics (Dunwoody, 2015). In this regard, the social networks have played a major role in this new relationship that exists between publics and conveyors of content. The discipline has found an interesting field in the social networks for communicating and disseminating scientific news to citizens (Castillo Ramírez & Alberich Pascual, 2017). Nevertheless, as mentioned above, this is not a sphere that is exempt from problems given these applications are fertile grounds for sowing disinformation (Salaverría et al., 2020). Journalists must combat fake news using the social networks to communicate more effectively, in the same way as the traditional media, but with special emphasis on verifying sources (Maiden et al., 2020).

A number of different success stories have been documented for using social networks to promote science, for example on Twitter, which is used positively by journalists due to the influential personalities who converge on the platform, along with the original content created on this application (Denia, 2021). In effect, this network serves as an important source of content generation and boasts an active scientific community connected to the audience and other disciplines (Jünger & Fähnrich, 2020). Facebook and YouTube are other social networks most used in science, taking advantage of their multimedia capabilities and the possibility of achieving science literacy via attractive and emerging channels (Vizcaíno-Verdú et al., 2020).

Instagram, furthermore, has become a network used extensively for journalism, where its audiovisual and graphic capacities are valued for awakening scientific curiosity and interest (Sidorenko-Bautista et al., 2021). In fact, there is increasing evidence of studies that take account of the informative possibilities of TikTok for communicating science. Despite it being one of the most recently introduced networks it has, due to the coronavirus pandemic amongst other factors, undergone a disproportionate increase in users (Abidin, 2021). Works of reference in relation to TikTok are still scarce due to its relative infancy, although positive experiences have been detected in it being used for showing experiments, creating challenges and encouraging compliance with health protocols via educational videos (Amir, 2020),

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and it has even been a valuable platform for disseminating information on coronavirus. In fact, videos including this hashtag have surpassed 111 trillion views (Saud et al., 2021).

As previously indicated, the social networks have become a vehicle for promoting transmedia stories. However, these types of actions have not necessarily been solidly incorporated into the day to day of science journalism, as much as the use of these social applications are being adapted to journalists' natural way of working (Pérez-Rodríguez et al., 2018; Perreault & Ferrucci, 2020). For authors such as Adam Matei & Hunter (2021) science itself and the process of discovery have great potential for becoming good narratives, for the reason that there is a constant delivery of "new and unexpected explanations" (p.315), which can help people ask more and new questions. This is why one of the current challenges for science journalism is to successfully determine how to incorporate these disruptive elements to better communicate its message. In this way, and with all these digital options at its disposal, it will be possible to contribute towards responding to the unresolved question of what capacity for reinvention the discipline has.

RECOMMENDATIONS FOR INCORPORATING TRANSMEDIA NARRATIVES INTO SCIENCE JOURNALISM

As discussed in this chapter, the authors consider relevant including transmedia elements as a vehicle for the communication of science. Its benefits in terms of the creation of narratives, the expansion of universes, the formation of communities and the inclusion of new stakeholders, contribute to forging a new path for the execution of the profession and for the use of the current technologies. Thereby, theoretical recommendations are included based on the experience of various experts and taking the specialized literature as a reference. Moreover, as practical recommendations, we suggest the essential elements that must be considered when applying transmedia content in science journalism.

Theoretical Recommendations

Harmatiy (2021) in her study on science coverage and media consumption in the Ukraine raised an interesting question for the development of the profession: What do the audiences that consume science want and what do they really need? Despite the fact that is a work focused on this eastern European country, it is still interesting how these same views can be extrapolated to a large part of the world. One of the answers is that all said and done, a science story should talk about what it is, anything new that has been obtained and, especially, what the benefits to the public are. And no less importantly, the study by Hamatiy reveals that the internet is the most promising platform for covering and communicating science. Thus, starting out from this idea, it can be stated that the mix promoted by such an immediate and immense world as that of the social networks, added to the possibilities of expansion that transmedia narratives offer, make this era a fertile period of opportunities for enabling the scientific message to reach people. This is why it is essential to promote training and foster advances in the context of the exercise of science journalism as an essential element for "building a better society" (Cassany et al., 2018, p.17). The big problem to arise is determining how to incorporate these valuable tools into science journalism so that it acts as a transformed medium for telling stories.

In this regard, there are experiences in the sphere of transmedia narratives that may provide an answer to this and serve as an example for strengthening and promoting interactivity, multiplatforms, viraliza-

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tion and co-creation in the exercise of the discipline, transforming it into a disruptive tool that reinvents the ways in which news from the area of science is communicated. In this sense, Kippes (2021) is clear when arguing that video is an excellent tool for communicating science in digital environments. Its hypertextual and multimedia nature promotes the viral interaction that occurs on social networks, and can be a good element for brand positioning. Furthermore, users are incorporated as important parts for introducing content, sharing it and adapting it to their own interests. On this point, scientific journals are no longer the sole source for informing oneself about specialist topics, given that they are beginning to share the space as a narrative structure with new tools and actions. One example is the incorporation of the audiovisual resource as a dissemination tool.

Moreover, Chomón-Serna & Busto-Salinas (2018) talk about how the Atapuerca scientific project has used the transmedia narrative to show what is taking place in these archaeological sites and foster direct experiences with users. They thus achieve the creation of a system in which the contents initially communicated from official project sources are extended and expanded upon by recipients, either via social networks, traditional media or via the creation of content by users. In this way a community is built of enthusiasts that enjoys archaeological investigation and produces information that is of direct benefit to the scientific project.

In recent years, and a result of digitalisation and the use of social networks, the podcast has come to the fore as a space for creating content and tackling diverse topics, via an audio format generally listened to recorded (Celaya et al., 2020), that is, asynchronously. Positive experiences have been documented at science communication level, for example that registered by De Lara González y Del Campo Cañizares (2018), in which the podcast has permitted the attraction of audiences, the gaining of their loyalty to the content, and their involvement when presenting science news. To do so programmes are produced that are then promoted on the social networks, which allow the exchanging of comments, providing new perspectives to original information.

Other experiences in the field of science journalism are those collected by Picó et al. (2018) and the Agora Digital project of the Universitat Jaume I (Spain). In this case the use of a collective blog and the commitment they make to engaging in dialogue with the audience via Twitter has promoted a positive response in institutional science communication, reaching citizens more immediately and achieving a more flowing and dynamic conversation. Science museums have also put a stake on transmedia narratives for communicating their daily activity. The experiences of Tabares-Robales (2021) and Fernández Fernández et al. (2021) likewise reveal satisfactory actions in this field. The development of digital collections, interactions with the public and other online services have afforded an expansion of content via the social networks and a greater proximity to audiences.

In short, the application of transmedia narratives in science should be focused on users, as recipients, but also content creators. It can be said that in order to multiply the expansion of stories conveyed it is essential to use the social networks, as they allow for greater viralization and dialogue with audiences. There needs to be a promotion of the space for the public to imagine and produce, feel part of the narrative, and contribute to the construction of the story, with their comments and visions. It is also important for the creation of contents to include the application of the different available digital tools, with emphasis on audiovisual, graphic and 3D content. Likewise, these disruptive actions should contribute to combating fake news, serving as verification platforms in the fight against the disinformation that is generated and disseminated, generally, via the social networks.

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Practical Recommendations

Trillo-Domínguez & Alberich-Pascual (2020) carried out a classification of the degrees of transmedia innovation and evolution in journalistic content and communications media, focusing on levels of re-invention that science journalism is undergoing as a discipline, and how to incorporate the languages specific to each narrative. Starting from this characterisation, which has been updated and adapted based on the bibliographical review carried out, we propose a classification of essential elements that must be present to consider a communication of science under transmedia modalities (see Table 1). Our proposal establishes three degrees of evolution: i) adaptation, when the use of transmedia narratives is exploratory, ii) expansion, when there is a high level of multimedia development and considerable interactivity with users and iii) disruption, the highest level, produced when there is a breaking away from traditional communication formats, with an optimum use of multimedia and hypertextual content, with high levels of expansive interactivity that promote co-creation, the fight against disinformation and the translation of scientific language.

Table 1. Essential elements for generating transmedia content in science journalism

Degree of innovation and transmedia evolution in science journalism		
Adaptation	**Expansion**	**Disruption**
• Interaction: Social network usage, without greater exchange • Multimediality: Content is generated, on the whole textual, with reduced audiovisual actions • Co-creation and expansion of content: Promotion of sporadic actions for the audience to generate content. A directional expansion occurs, only via one channel. No greater use of hyperlinks in content • Translation of scientific language: Tells what the story is about and its novelty. Predominance of the documentary source	• Interaction: There is an increase in social network usage, comments are responded to and, periodically, actions are promoted that facilitate encounters • Multimediality: An increase in audiovisual content, there are reports and interviews, videocolumns and short clips. There is a considerable use of design. • Co-creation and expansion: There is an invitation to create content. Audiences participate and send narrative productions that will not necessarily promote an expansion of the brand There is use of hyperlinks and expansion is generated through two channels. Consistent narrative between each story • Translation of scientific language: Tells what the story is about and its novelty. The news story is analysed. There are documentary and live sources • Combats against fake news: No promotion of disinformation; instead, informative actions are generated through explanatory journalism that contribute to the fight against post-truth	• Interaction: Diverse social networks used continuously to encourage communication with audiences. User comments and contributions responded to. Actions for involving audiences proposed (questions, surveys, etc.) Direct action with the science medium, institution or project made possible • Multimediality: Explosion of non-traditional formats such as podcast, video-documentary, clips, v-logs, gamification, news alerts, interactive infographics and virtual tours. The narrative has high levels of design • Co-creation and expansion of content: Audiences invited to be part of the content production to strengthen the brand. A community is formed. The narrative is multiplatform and is expanded to more than three channels, for example, newsletter, traditional mediums, social networks, websites. Hyperlinks promote jumping from one medium to another. Stories are linked and the narrative is consistent • Translation of scientific language: There are visible documentary sources. The authors of the investigation are considered to be those to respond as a source. The news story is analysed and has an educational perspective. The contents give a response to what the story is about, what new element it contributes and how this affects citizens. • Combats against fake news: The narration leaves no space for disinformation. Stories, strategies and tools for fighting against post-truth are proposed. There are mechanisms and a fact-checking team to verify news and identify fake news.

Source: (Own creation based on Trillo-Domínguez & Alberich-Pascual (2020) and literature cited in the study).

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FUTURE RESEARCH DIRECTIONS

Be it due to the appearance of the printing press and the birth of the first newspapers, to the widespread growth of television, or to the arrival of the internet that brought with it a complete digitalisation of newsrooms, journalism has been a discipline that has known how to adapt to the times and technological revolutions. Therefore, exploring new and better communicative horizons will always be one of the great challenges that the profession must face. To the extent that technology advances and daily life is digitised, new tools are arising to be able to produce and disseminate informative messages, as well as new channels that contribute to reinventing journalism.

Social networks and transmedia narratives are one of these paths. In addition, other new paths may arise in the near future. Something that will create a great change in the way society communicate, to which a large part of what this chapter have put forward in this work could be widely surpassed. Nevertheless, it is fundamental at this point to take advantage of this type of tool to generate journalistic messages, especially those directly related to the communication of science. The pandemic due to coronavirus, climate change, health emergencies and the fight against fake news show that, as a society, live in a world that needs science and makes it necessary to know what is being done in science. Both putting digital tools to good use and creating strategies that permit paths to be opened between the numerous stimuli are bombarded day by day, with is becoming an essential challenge. Overcoming these obstacles and being able to assimilate and share what the world's scientists are doing can contribute to public knowledge and participation in science, and access to useful and truthful information.

The fact that the type of transmedia actions that this chapter have referred to are not applied in a consistent manner in science journalism could create prejudice when experimenting with the new. There are not many more experiences, other than those compiled here, that permit it to be verified whether science journalism is communicated in this manner. However, is being bet on the fact that better audience interaction would be obtained and a greater expansion of scientific knowledge would be achieved, as well as constituting a new challenge for all agents involved.

As a future line of research, then, it would be interesting to analyse the implementation of the recommendations offered here as regards the application of transmedia narratives in contexts of science journalism. Thus, it could be examined to what extent positive interactions with audiences and better responses to news content are achieved. In addition, the initial foundations are laid for creating case studies on mediums of reference in science journalism and, in this way, there is an evaluation of the degree of transmedia evolution for the dissemination of science according to the table proposed. Moreover, this study encourages the development of analyses of journalistic content and which permit the identification of possible new narrative formats (exclusive or not) of science communication.

Another interesting aspect to be explored is the relationship of emerging social media to transmedia narratives, and how these tools may be applied to the dissemination of scientific news. A platform as TikTok that has progressively become one of the most popular social networks among the young public, serves as a good starting point to analyze the implications of this type of narrations. These two aspects may be key for the future of communication in science: *i)* how to attract the attention of Generation Z, who are not necessarily regulars of news transmitted by the traditional media, and, simultaneously, *ii)* benefiting from the virtues of growing networks such as TikTok, with its own languages and codes, that can promote the construction of narratives and communities in order to find new disruptive tools in scientific communication

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The intention behind this chapter has been to show, in the opinion of the authors, what the clear benefits to using the social networks are and how, by applying transmedia strategies, contributions can be made to reinventing the communication paths upon which science journalism relies.

CONCLUSION

Science journalism has undergone a resurgence that is difficult to deny, and with each passing day the importance of knowledge about what is happening in the field of science has grown, especially in these times of lockdowns and pandemics. But it is not the only disease that society is facing in these times: the disinformation and fake news that constantly appears is becoming a battle that science journalism must face in order to recover credibility and, why not, strengthen bonds with the younger public, who are increasingly moving away from traditional communication paths.

Transmedia narratives, and any other kind that serves as a medium for bringing science closer, are becoming weapons for fighting against the aforementioned difficulties. Technological progress must be an ally to the profession, not a hindrance. In this way, journalists should be concerned about delivering a rigorous and effective message, taking advantage of digital capabilities, to thus be able to connect with publics who are often removed from these topics.

Journalism should not be afraid of what technology provides and it is important to open arms even wider to innovating initiatives such as gaming and virtual reality, which can become positive tools for communicating content. The dissemination of science does not have to be synonymous with, as many often think, the tedious repetition of content; it should also be capable of taking advantage of innovations and carrying out communication with a clear sense of entertainment via innovative channels.

The discipline has much to learn and experience but, above all, many stimuli with which to be able to reinvent itself. These are times for science journalism, for those who engage in it, who dare, seek new disruptive formats and employ all existing incentives for delivering science news.

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KEY TERMS AND DEFINITIONS

Digital Environment: Place where platforms, applications and users that make up the internet network converge.

Disruption: The highest level reached in the transmedia narrative, when the media break with traditional communication formats, with stories that have high indices of interactivity, expansive, promoting co-creation and responding to different journalistic questions.

Expansion: Possibility a story has of being promoted thanks to user creations, permitting new audiences and interactions.

Interactivity: The relationship users have with mediums, or users amongst themselves, in this case via the social networks.

Multimediality: Integration of hypertext, animation, graphic or audiovisual elements for conveying messages.

Science Journalism: The social communication of content on science and technology, carried out by journalists and transferred in multiple directions and publics to inform about their daily work, advances and other aspects relating to the scientific discipline.

Social Networks: Social platforms comprising different publics, which have had their apogee with digital advances, and which permit the transmission of messages and exchange of information between users.

Transmedia Narratives: Story amplified coherently by different platforms and users, utilising digital and social technologies to achieve greater interactivity and make a story grow.

Viralization: Content that is shared on social networks and achieves wide dissemination on the part of users.

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Chapter 25
The Low-Code Movement: Accelerating Digital Transformation With Low-Code

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ABSTRACT

Low-code is one of many topics that have been brought up to address two perennial problems: the growing shortage of software developers and the methodological gap between business requirements and implementation. With low-code, you give business users and process owners the tools they need to build systems and make process improvements on their own, with minimal technical support. To be successful, digital strategy initiatives today and in the future will need to think of and include tools that empower their business users and help accelerate process automation. This chapter provides a general understanding of low-code platforms, explores the current research on the topic through a bibliometric analysis, and analyses the impact of low-code on digital transformation.

INTRODUCTION

Transformation can mean different things for different companies. Depending on each digital transformation journey, it could simply mean digitization of paper-based documents and processes, or it could mean introducing easy, remote access to on-site resources, or automating customer-facing applications. According to (McKinsey, 2018), 8 out of 10 respondents from different enterprises mentioned that they've undertaken such efforts in the last five years and only less than 30% have succeeded. It is therefore necessary to carefully understand how to approach digital transformation projects and to understand what the building blocks and obstacles of such initiatives are.

In enterprises, information is stored everywhere, from file systems, to emails, to social data, to structured and unstructured information. Employees and customers expect a seamless, integrated experience that leverages all this information. One thing that is very consistent and common across organisations around the world is communication, content, and processes. To enable successful digital transformation, businesses need to manage end-to-end processes, ensuring that communication, content, and processes

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are glued together, which means ensuring a consistent flow of information across all departments. This is possible when there is technology embedded in processes that connects processes and systems, and when the content flowing through all systems is consistently anchored in an appropriate and permanent context, making less and less reliance on human intervention and participation necessary.

A highly favourable approach to digital transformation is the use of *low-code* application development platforms. These platforms now go by different names, the most used ones being *low-code* platform (LCP), *low-code* application platform (LCAP), and *low-code* development platform (LCDP). *Low-code* application development and *low-code* platforms (referred to interchangeably as *low-code* throughout this article) provide a tipping point for organizations to really start taking advantage of digital transformation and process automation in ways that were not available to them before. *Low-code* is a new class of software development environments that has emerged in recent years, prospected as offering a substantial increase in software development productivity and to yield new ways of promoting business IT alignment and user empowerment.

Low-code, as a philosophy and methodology, has its roots in business process management and business automation. It is increasingly becoming a mainstream movement, rooted in a paradigm closely related to the *DevOps* set of practices, which combines software development (Dev) and IT operations (Ops), anchored in the mantra "you build it, you run it". Equivalently, in terms of business processes, the business users, who are the actual owners of business processes, should be empowered so that they can also control the processes: "you own it, you control it". By controlling a business process, business users should be able to configure and adapt each step of a business flow, without having to rely on developers or IT staff to do so. *Low-code* attempts to achieve exactly that: to empower the business user to an extent that they can model the business processes (workflows, data flows, parameters, behaviours, event management, etc.) themselves. As an effect, *low-code* helps to embrace digital transformation faster, digitizing and automating workflows and building scalable process-centric applications.

According to (PMI, 2020), 86% of IT decision makers consider the biggest hurdle to digitally transforming their business to be the lack of software developers. Gartner coined the term 'citizen development' in 2009, meaning you don't need to be a professional developer to build applications. *Low-code* platforms are targeting this goal, and mainly address business users. Some *low-code* application development platforms address professional developers too. For professional developers, the benefit of using such a platform is that they manage to get more done in less time, often with better and more reliable results and arguably more consistent results.

Therefore, not all *low-code* platforms are the same. There is a lot of confusion in the market (Forsyth, 2021). In this article, in addition to a general understanding of the different types of *low-code* platforms, a bibliometric analysis is presented, focusing on understanding the current research trends around *low-code*. The analysis leads to the identification of further possible research directions as well as on understanding the impact of *low-code* on digital transformation. Each *low-code* platform has its own characteristics, making it more suitable for certain goals of the digital transformation journey than others. But in essence, *low-code* platforms provide the core technology for organizations undergoing digital transformation, helping them accelerate their transformation cycle, innovate, and adapt faster. Thus l*ow-code* platforms are essential for every enterprise. If businesses are looking to modernize their operations, if they want to adapt faster to the needs of their customers, *low-code* certainly plays a key role in their journey.

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BACKGROUND

The term *low-code* was presumably first introduced to the public by Forrester Research (Richardson & Rymer, 2014), which states that firms prefer to choose *low-code* alternatives for fast, continuous, and test-and-learn delivery. Since then, market research institutes forecast a growing relevance of *low-code* development platforms for organizations. Gartner's Magic Quadrant "*Enterprise Low-Code Application Platforms*" and Forester's Wave "*Low-code Development Platforms*" are just two examples of major struggles being made to understand, classify, and monitor the activities around *low-code*. Moreover, the rising number of scientific publications in recent years shows the increasing interest of the academic community for this topic.

Considering the above, this chapter addresses the existing knowledge on *low-code* and describes the current research state covering the topic.

UNDERSTANDING LOW-CODE / NO-CODE PLATFORMS

Low-Code Versus No-Code

Low-code platforms and *no-code* solutions can be easily confused. In reality, they can be distinguished based on small details and capabilities.

Low-code and *no-code* terminology itself is misleading, as the distinction isn't about whether people need to code or not. The distinction is more about the types of people using these platforms to build applications. In the *no-code* corner are the 'citizen developers' – business users who can build functional but generally limited apps without having to write a line of code. The *low-code* corner, in contrast, centres on professional developers, streamlining and simplifying their work – delivering enterprise-class applications with little or no hand-coding.

Low-code is a way for developers of all skill levels to design applications quickly and with minimum hand-coding. Usually this happens by dragging and dropping visual blocks of existing code into a workflow to create applications. This visual construction of an application implies that a developer can go straight to creating something new with added value, instead of learning specific languages, frameworks, libraries, which they would have to know beforehand to hand code some basic functionality. Skilled developers work smarter and faster with *low-code* because they are not hamstrung by repetitive coding or duplicating work. Instead, they focus on the business logic and on the differentiating aspects of an application, using their development experience and skills to architect it all and leaving the grunt work to the *low-code* tool or platform. *Low-code* enables you to build user-friendly, responsive apps – since the *low-code* platforms and tools are designed to offer these benefits. There is enough simplicity inherent in *low-code* tools to get those apps up and running much faster than if you were to hand-code them.

No-code solutions also feature drag-and-drop, visual development. Unlike *low-code*, they mostly cater to business people or others in IT who may not know any actual programming language but want to develop an application for a specific use case - often for their department.

Gartner predicted back in 2020 that by 2023, over 50% of medium to large enterprises will have adopted a *low-code* or *no-code* as one of their strategic application platforms and that *low-code* will be responsible for more than 65% of application development activity by 2024.

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For their "Enterprise Low-Code Applications Platforms" Magic Quadrant, Gartner defines *low-code* application platforms like this: "*An Enterprise Low-code application platform (LCAP) provides rapid application development and deployment using low-code and no-code techniques such as declarative, model-driven application design and development together with the simplified one-button deployment of applications. An LCAP typically creates metadata and interprets that metadata at runtime and abstracts the underlying server infrastructure for ease of use; many also allow optional procedural programming extensions. LCAP supports: • UI capabilities via responsive web and mobile apps • Orchestration or choreography of pages, business process, and decisions or business rules • Built-in database • "One button" deployment of applications".* Additionally, Gartner defines a *no-code* application platform as an LCAP that only requires text entry for formulae or simple expressions. The LCAP market therefore includes *no-code* platforms too. Furthermore, *no-code* is not a sufficient criterion for tasks like citizen development, as many complex tooling configuration tasks are *no-code* but still require specialist skills.

(Bock & Frank, 2021) distinguished four rough categories of *low-code* platforms: (1) simple data management platforms, (2) classical workflow management systems, (3) extended, graphical user interface (GUI)- and data-centric IDEs, and (4) complex multi-use platforms for business application configuration, integration, and development. There isn't any similar categorization available for *no-code* platforms since they fall into the broader *low-code* application platform spectrum.

LITERATURE REVIEW

A Bibliometric Analysis

To understand the research interest in *low-code*, a bibliometric analysis was conducted. The preliminary bibliometric analysis was based on the frequency of occurrence of keywords, which are a real point of interest in scientific research, often used in titles, abstracts, and specific sections, as well as for indexing in databases. The Clarivate Web of Science database was chosen for the proposed analysis. The methodological steps of the preliminary bibliometric analysis are as follows:

Defining Search Characteristics and Data Collection

1. **Search criteria**
    a. Database: Clarivate Web of Science
    b. Search mode: String Query-based advanced search
    c. Inclusion criteria: All languages/all document types
    d. Timespan: 2000-2022
2. **Search Keywords**
    a. Reference strings: low-code, no-code, "low code", "no code", lcdp, lcap
    b. Defined Boolean query: ALL=("low code" OR "no code" OR "no-code" or "low-code" or "lowcode" or "nocode" or "lcdp" or "lcap")
3. **Determining and visualizing bibliometric networks**
    a. Data Processing
        i. Software: VOSviewer 1.6.18
        ii. Map-type: Co-occurrence map based on text data

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   iii. Considered Fields: Title and abstract
   iv. Counting method: Full counting
   v. Threshold: Minimum number of occurrences = 5
b. Keywords filtering
c. Data visualization: co-occurrence network
d. Keywords clustering: none

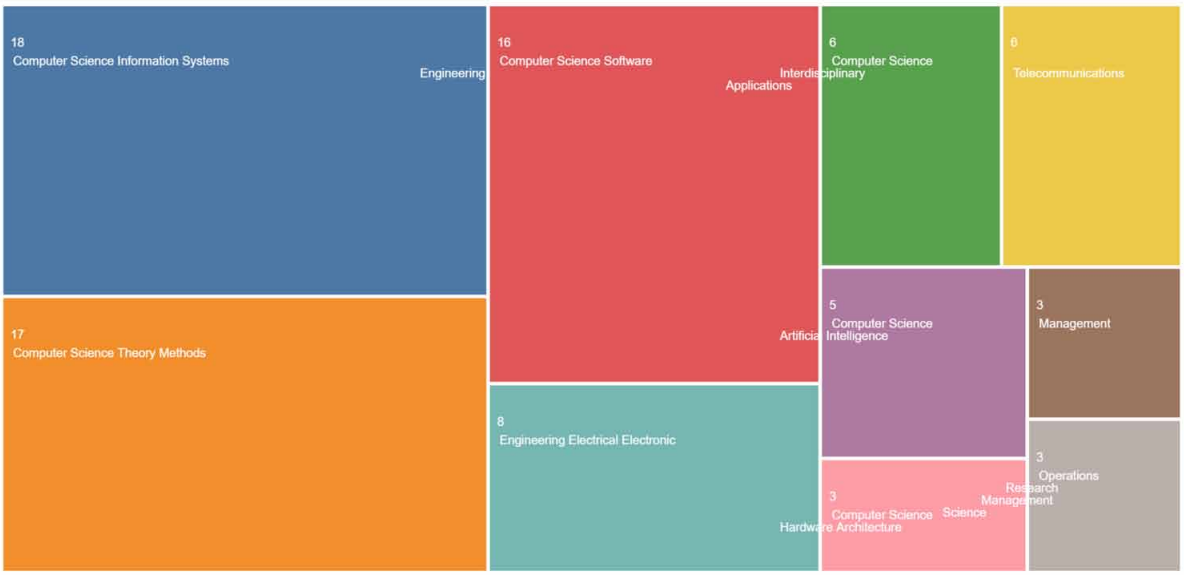
4. **Data analysis and bibliometric study discussion**
   a. Directions of main interest
   b. Interpretation of structures

Selecting keywords that best reflect the research topic under consideration is undoubtedly a very important step. As there is no clear and definitive taxonomy on the topic, in addition to *low-code* and *no-code*, the query string has been extended to include *lcdp* (Low-Code Development Platforms) and *lcap* (Low-Code Application Platforms). The Clarivate Web of Science database was considered for this research not by chance, but because of its popularity and recognition as one of the most reliable international databases. At the same time, Clarivate Web of Science offers researchers with multiple advanced search possibilities through specific tags. This allowed for a subsequent refinement of the hit list. Querying the database with the search query ALL=("low code" OR "no code" OR "no-code" or "low-code" or "lowcode" or "nocode" or "lcdp" or "lcap"), 758 scientific papers published during 1978-2022 resulted. To refine the list, we first limited the time range to papers published during or after 2014 (the agreed year of the coining of the *low-code* term) and secondly refined the categories to Computer Science (CS)-related categories only: CS Theory Methods, CS Information Systems, CS Software Engineering, CS Artificial Intelligence, CS Hardware Architecture, CS Interdisciplinary Applications. By refining the search list, we arrived at 133 results. In the next step, title, keywords and abstract of each paper were screened to exclude those that were neither relevant nor related to the research topic. A lot of articles have been removed since they referred to other topics, such as "low code coverage". The final set of papers included 41 articles that were appropriate for *low-code* domain analysis. Subsequent import into VOSviewer software resulted in the identification of 76 terms with a minimum threshold of 4 occurrences. Based on the relevance score calculated for the resulting terms, the 60% most relevant terms were extracted, resulting in a total of 46 keywords.

Following the advanced search within the Clarivate Web of Science database, the raw results obtained reveal some general aspects regarding the interest in the research topic from a literature perspective. The subject matter, as reflected by the defined query, was analysed from several perspectives, as existing research covers a limited number of areas within the database considered. Except for the expected categories and multiple categories related to computer science, the presence of the Management and Operations Research Management Science categories indicates a growing interest in the *low-code* phenomenon for management and business operations. *Figure 1* illustrates the top 10 research domains in which the papers resulting from the database query are included.

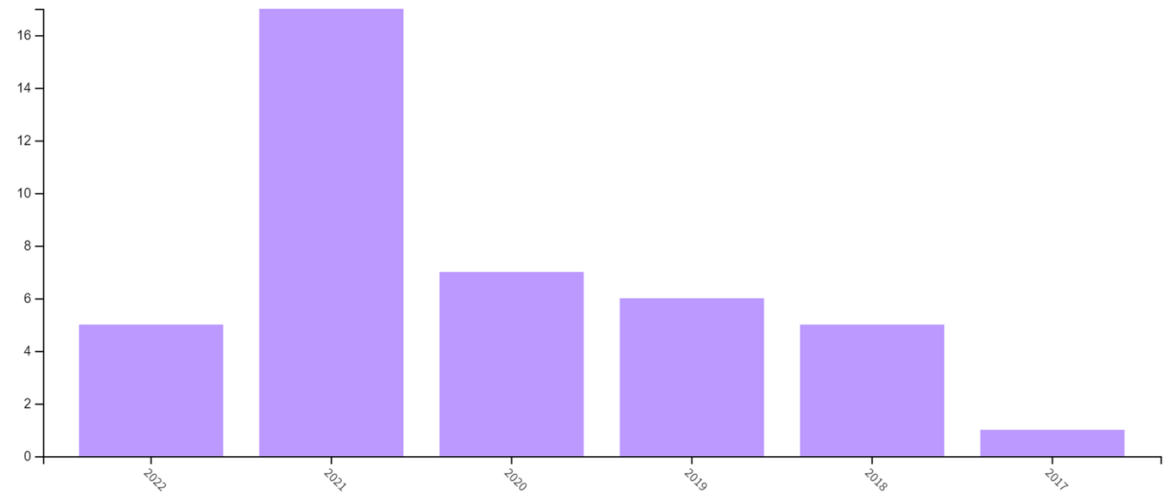
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Figure 1. Top 10 research areas that include papers reflecting the analysed phenomenon
Source: Clarivate Web of Science - Results obtained after querying the database



Undeniably, the preliminary results made available to the authors via the Clarivate Web of Science platform highlight the progressive interest in the topic. As expected, researchers' interest in the topic has steadily increased over time (*Figure 2*). Given the timing of this research (early 2022), the lower number of papers for this year is noticeable, but this certainly does not reflect a decrease in interest in the phenomenon, since results do not cover a full year. Importing the resulting papers, visualising the data, and analysing the association between key terms are the steps that provide valuable information for the public and are detailed in the next section of this research.

Figure 2. Yearly distribution of resulted papers
Source: Clarivate Web of Science - Results obtained after querying the database

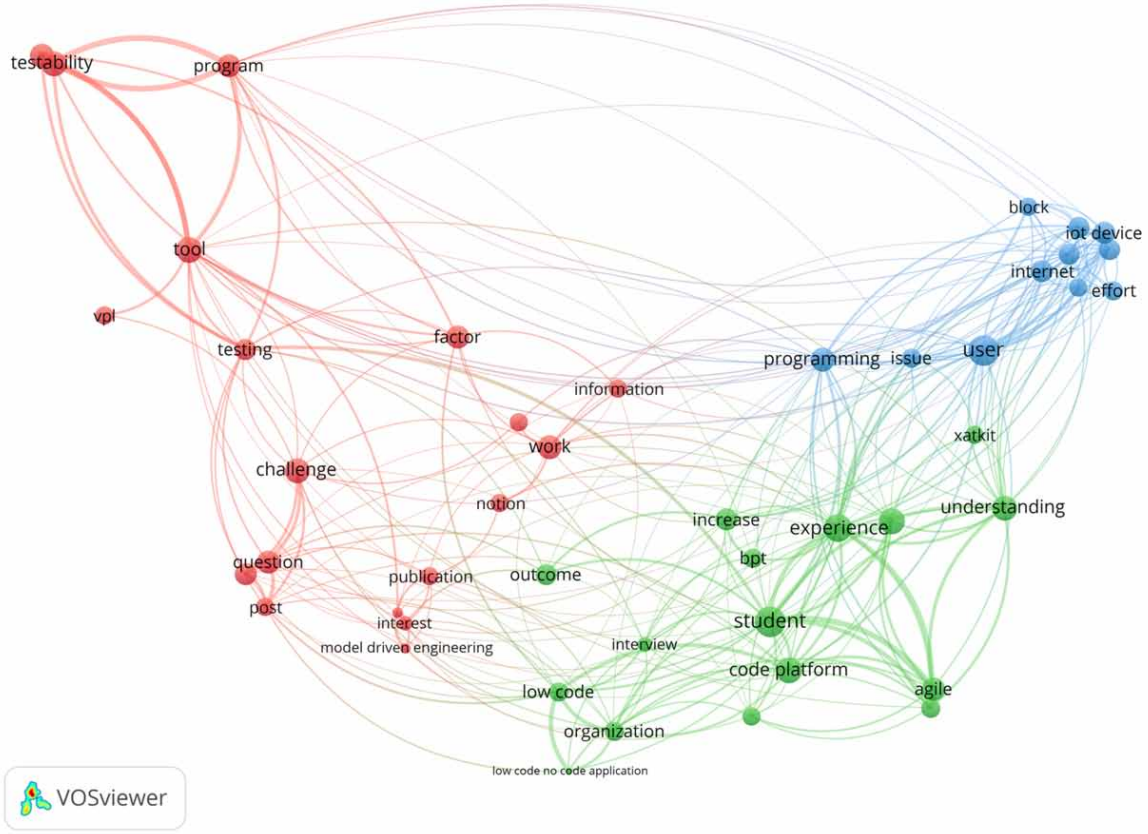


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Data Visualization and Clusters Formation

As a further processing step of the titles, abstracts and keywords resulting from the query of the Clarivate Web of Science database, the keywords considered relevant for this analysis formed the keyword co-occurrence map. *Figure 3* shows the associated keywords as distinct coloured clusters, the size of the nodes formed by the terms included in the analysis being given precisely by their frequency of occurrence.

Figure 3. Keywords co-occurrence map
Source: Results obtained from data processing via VOSviewer



A point of real interest in bibliometric research is clustering based on keyword associations. In this case, each node in the keyword occurrence frequency map is associated with another base node, with a maximum number of occurrences within that cluster. In the present research, the processing of the results led to the formation of 3 main clusters, the number of which is determined by a resolution parameter. As can be seen in *Figure 3*, the red and green clusters are predominant and have core key terms directly related to *low-code*, while the blue cluster starts from the key terms "user" and "programming".

The clusters provide an opportunity to summarise the main points of view of existing research. In the present review, to review the scientific literature identified as relevant, each individual cluster was considered as a key benchmark. Thus, through a manual and to some extent incomplete processing of

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the papers resulting from querying the Clarivate Web of Science database, the main cluster-based findings can be described as follows:

- **Cluster 1 (red):** Key terms in this group indicate the general interest in researching the topic. Keywords such as challenges, interest, question, information are related to the understanding of the phenomenon and are not surprising for a suit of research papers. Relevant articles for this cluster are (Al Alamin et al., 2021; Hurlburt, 2021; Luo et al., 2021; Prinz et al., 2021)
- **Cluster 2 (green):** Key terms in this group indicate the implications of *low-code* on organizational experience, methodology and outcomes. It appears to encompass topics related to operational efficiency and general understanding of the phenomenon within organisations. Relevant articles for this cluster are (Richardson & Rymer, 2014; Sanchis et al., 2019)
- **Cluster 3 (blue):** this cluster groups 3 main terms (user, programming, problem), which indicates the relevance of *low-code* for business users by focusing on programming problems. As this cluster is visually separated into two sections (where one is user-centric and the other technical), it brings together the user-centric aspect of *low-code* and the technical aspects, glued together by the need for programming to be done. The keyword *low-code*, present in this group, has its main associations with experience, user, work, factor and challenge. Relevant to this cluster is (Alsaadi et al., 2021) work which analyses on the factors that affect the utilization of *low-code* platforms.

Table 1. Keywords and relevant associated terms

Keyword	Cluster	Associated top five most encountered key terms
low-code	green	experience, user, work, factor, challenge
low-code development environment	green	code platform, student, challenge, understanding, programming
code platform	green	programming, user, tool, student, experience
work	red	user, experience, question, low-code, challenge
experience	green	agile, student, work, tool, program, code platform
user	blue	work, programming, experience, student, understanding
company	green	understanding, question, work, organization, agile
challenge	red	testing, work, programming, student, tool
programming	blue	challenge, student, experience, understanding, program

The description of the grouping and the association between the main terms (*Table 1*) summarize the main research efforts in the reviewed literature, as follows:

1. Understanding the phenomenon (red)
2. Impact on organizational experience and methodology (green)
3. Impact on user's activity (blue)

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Defining Low-Code

Although the research around *low-code* is at a very early phase, several studies exists, covering a broad spectrum of areas. (Sanchis et al., 2019; Waszkowski, 2019) analyse the applicability of *low-code* in the manufacturing industry and (Bhattacharyya & Kumar, 2021) study the improvement of supply chain management' digitization through the deployment of *low-code*. (Sahay et al., 2020) presents a technical survey of different *low-code* platforms based on a proposed conceptual comparative framework. (Ihirwe et al., 2020) present the current state of research on model driven engineering approaches for IoT by considering *low-code* development platforms.

(Di Ruscio et al., 2022) compares *low-code* and model-driven approaches, identify their differences and commonalities, analyse their strong and weak points, and propose directions for cross-pollination. The cross-pollination necessity is also found in the work of (Ruscio et al., 2021), which supports the idea that *low-code* development platforms are model-driven at their heart and proves that closer interaction and cross-pollination are highly beneficial for the *low-code* and model-driven engineering communities.

(Al Alamin et al., 2021) and (Luo et al., 2021) both present an empirical study of developer discussions in the developer community Stack Overflow on the challenges of *low-code* development platforms. (Al Alamin et al., 2021) researches the related topics and their mapping on *low-code* life cycle stages, whereas (Luo et al., 2021) presents insights on the descriptions and characteristics of *low-code* platforms, as well as the pros and cons brought by *low-code*.

The framework proposed by (Overeem & Jansen, 2021) describes the different subsystems and artifacts in a *low-code* development platform, the different types of professionals involved, and how these professionals can use impact analysis to support their engineering decisions.

A first scientific and structured literature review on *low-code* platforms was carried out by (Prinz et al., 2021). The aim of their study is to analyse and classify the current research on this topic and to identify any gaps in research. Their analysis of the current status-quo in several databases showed that in 2020 the number of published papers increased enormously compared to previous years. Not surprisingly, during the first pandemic year of COVID-19, interest in digitalisation - and therefore in solutions to accelerate and support digital transformation - has grown. (Prinz et al., 2021) classifies all publications based on the socio-technical system model defined by (Bostrom & Heinen, 1977). Their analysis shows that more than half of the publications focus on Technology, and of these papers, 86% show a strong emphasis on the technical system part of the socio-technical model. Only 9% of publications could be rated with the highest confidence in one component of the social system. The main finding of the literature review is that many components of the social system are almost unresearched and, especially about the distribution of roles between business and IT (respective responsibilities, alignment processes, communication), not sufficiently or not at all researched. As for citizen developers, although they should undoubtedly be on the top of *low-code*'s list of objectives, the attitudes, skills, and values needed by the people who must use *low-code* platforms have not yet been researched.

Definitions of Low-Code

Based on the literature review, some of the most relevant definitions for the *low-code* paradigm have been collected and presented in *Table 2*.

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Table 2. Definitions and acronyms

Source	Definitions	Acronym
(Al Alamin et al., 2021)	Low-code software development (LCSD) is an emerging paradigm that combines minimal source code with interactive graphical interfaces to promote rapid application development.	LCSD
(Di Ruscio et al., 2022)	Low-code development platforms (LCDPs) are advertised as visual development platforms, typically running on the cloud, reducing the need for manual coding and also targeting non-professional programmers	LCDP
(Luo et al., 2021)	Low-code here means creating software with radically small amounts of code, or even without hand-coding	LCD
(Frank et al., 2021)	The term "lowcode platform" (LCP) designates a class of application development platforms that aim at boosting development productivity and clearly reduce the amount of coding.	LCP
(Forsyth, 2021)	Low-code is a way for developers of all skill levels to design applications quickly and with minimum hand-coding by dragging and dropping visual blocks of existing code into a workflow to create applications.	
(Gartner, 2022)	An Enterprise Low-code application platform (LCAP) provides rapid application development and deployment using low-code and no-code techniques such as declarative, model-driven application design and development together with the simplified one-button deployment of applications.	LCAP
(Sanchis et al., 2019)	Low-code development platforms are ecosystems with which apps can be developed, minimizing hand-code definition manually, because it is already built and prefigured.	
(Vincent et al., 2020)	A low-code application platform (LCAP) is characterized by its use of model-driven or visual development paradigms supported by expression languages and possibly scripting to address use cases such as citizen development, business unit IT, enterprise business processes, composable applications and even SaaS applications.	LCAP
(Waszkowski, 2019)	The low-code platform is a set of tools for programmers and non-programmers. It enables quick generation and delivery of business applications with minimum effort to write in a coding language and requires the least possible effort for the installation and configuration of environments, and training and implementation.	LCDP
(Sahay et al., 2020)	Low-code development platforms (LCDPs) are easy to use visual environments that are being increasingly introduced and promoted by major IT players to permit citizen developers to build their software systems even if they lack a programming background	LCDP
(Richardson & Rymer, 2016)	Low-code application platforms are software environments that speed development and delivery of new apps by changing two dimensions of traditional platforms […]: how business apps are developed and delivered and […] how development platforms are acquired and consumed	

By analysing all definitions, we can summarize a generic definition for *low-code* platforms based on the general understanding of what it is, for whom it is and for what it is:

Low-code is a (*tool* | *platform* | *environment* | *ecosystem* | *paradigm*) **for** (*developers of all skill levels* | *programmers* | *non-programmers* | *citizen developers*) **and is intended to** (*create software* | *rapid application development* | *develop applications* | *generate business applications* | *build software systems* | *speed development and delivery*).

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Low-Code and Digital Transformation

(Sousa & Rocha, 2019) identified that the main skills needed for an effective digital transformation are artificial intelligence, nanotechnology, robotization, internet of things, augmented reality, digitalization. While these (and others) are some key emerging technologies, on which digital transformation heavily relies on, the regular applications and systems covering business processes still must be developed based on standard, mainstream technologies, through professional software developers. Given that most businesses are struggling to find the right tech talent (ComputerWeekly, 2021), they need to explore new approaches to meet the demands associated with digital transformation. *Low-code* helps by making coding less burdensome and reducing the time and resources spent in building digital solutions. In the *low-code* paradigm, anyone can develop applications, regardless of their technical expertise and, therefore, contribute to the acceleration of digital transformation.

Low-code development tools use a visual design format, rather than coding syntax, so designers not trained in computer science can use them to contribute to the development process. A user-friendly interface also lets designers get changes completed faster and more efficiently, and that saves time and money on labour resources. These tools use prebuilt libraries and functionality to accelerate development and maximize component reuse. About 70% of IT leaders found that *low-code* platforms are more affordable compared to traditional development platforms, according to Forrester (Rymer, 2019), and 80% cited the ability to meet requirements within budget.

Low-code platforms are helping companies to slash delivery times from months to weeks (or even hours), implement real-time updates, and deliver stronger applications driven by user feedback. *Low-code* provides capabilities that allow users to rapidly implement new (or adapt existing) business rules, screens and workflows, providing the needed flexibility of business environments.

Low-code can help automate the most critical and complex processes with drag-and-drop process modelling that allows users to build from existing applications and data. Companies recognize the need to transform their business and operating models to increase revenues in the digital era. Internal processes need to be streamlined, secure and connected. *Low-code* platforms aim to support business in exactly that.

Low-code platforms can play a central role in companies' digital strategy by reducing the time and money spent on traditional development processes and empowering enterprise employees to delve into development, regardless of their technical background. (Kharade, 2021) provides an overview on the most 5 relevant aspects of *low-code* which directly influence the speed of digital transformation:

Accelerating Visual Development

Low-code offers an intuitive user interface to design applications, websites, workflows and automation recipes. Development of applications is accelerated at different phases in the software development lifecycle. At the very first phase, the ideation phase, business users can create functional prototypes and iterate toward fully functional applications through *low-code*'s drag-and-drop functionality. In an already working business process, users can, through drag-and-drop interfaces, access connections to data sources and APIs, change workflows and adapt business rules with little to no coding. Development speed is increased through component reusability, provided by an extensive list of pre-built components and pre-configured modules. Using standard UI components such as menu bars, buttons, form sections, etc. allows a user to take advantage of pre-built UI components and merge them into a full-fledged application.

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Democratizing Application Development

Talent gap is one of the biggest hurdles to digital transformation. By turning a large number of semi-technical employees into citizen developers, companies can empower teams to create high-quality digital solutions for everyday operations while still meeting IT security regulations and addressing cybersecurity concerns. In addition to increasing the development resources, citizen developers can also help to accelerate business value. While they create business apps, the more complicated digital issues can be managed by the IT department.

Easy Data Integration

Tools built using *low-code* technology are highly customizable and scalable. Integration is the best way to extract the maximum value from existing systems. *Low-code* platforms enable the rapid creation of purpose-specific applications, which, via API connectors or building middle layers, can be "stitched" together with legacy applications to create end-to-end products.

Reduced Costs and Scalability

Low-code helps reduce backlogs by helping the development team do more in less time through visual building blocks that are easy to copy and repeat. These building blocks need to operate on data and to provide a continues context throughout the business process. Available connections to multiple data sources allow users to easily connect to data from different business systems and scale the application. Scalability of such applications is ensured by easy cloud deployment, which makes it easy to extend the application from one geographic location to another.

Eases Application Life Cycle Management

Depending on the platform, all the stages of the application life cycle—development, deployment, monitoring, maintenance, updates—can be performed from a single point in real-time, ensuring security, compliance, and version control. Application delivery and deployment is greatly accelerated, allowing users to deploy applications in just a few clicks, without relying on DevOps or engineering teams.

By having little code to maintain, the maintenance phase of software is greatly improved, which is very important, because in a permanently changing business environment it is vital to be able to quickly change what already has been developed.

CONCLUSION

Low-code development platforms accelerate digital transformation by making the software development process easier, faster, and more accessible to a larger base of users. Through high-level abstractions, both professional developers and citizen developers are supported to develop increasingly complex software systems. While this improves productivity and efficiency it also introduces new challenges in the development process, as presented in the literature review part of this chapter.

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The momentum generated by the *low-code* trend gives rise to various other inspired research opportunities. The trend is promoted by firm promises made by suppliers and market research firms, as well as by impressive success stories:

After Stemcell Technologies Inc., a Vancouver, British Columbia-based biotechnology company, moved some operations off-site, it developed within a day an application to track location, work and health status of its 1,500 employees with low-code tools from OutSystems Inc. (Shah, 2020)

Low-code is intended to help achieve goals that have long been at the heart of business information systems research. These include increasing productivity and reducing the cost of developing and maintaining enterprise software systems, improving the ability of organisations to adapt software systems to rapidly changing requirements, and empowering users. All these goals are at the intersection of many disciplines and as such the *low-code* trend is important for business information systems as well as for organisational management and business analysis.

Considering the multidisciplinary aspect of the subject presented in this study, there are countless opportunities for future research.

Firstly, the importance of *low-code* for digital transformation has yet to be explored. The ability to rapidly develop, adapt and deploy software is a key factor for the competitiveness of many companies. In terms of the forward-looking benefits of *low-code*, managers who are responsible for delivering software to organizations should consider the introduction of *low-code* platforms. To be able to do this, a systematic and thorough analysis of existing types, suppliers and features is required.

Secondly, the managerial implications on *low-code* are not sufficiently covered. Very little academic research focuses on the implications of *low code* on managerial decisions, operational processes, and personnel. Business software design requires analysis (and often change) of the organization of the action system to be supported by the software. Therefore, mutual alignment ("business-IT alignment") is required, which increases the overall complexity of the analysis and development process.

Thirdly, *Low-code* conceptualization and definition are currently too vague. The market indicates a wide range of products currently sold under the label *low-code*. There are at least a few dozen vendors selling products under the label *low-code*. In the academic literature, a clear concept of *low-code* has not yet evolved. Often, *low-code* platforms are characterized too vaguely and too broadly.

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KEY TERMS AND DEFINITIONS

Business Process Management: Business process management is a sum of activities related to business processes, including discovery, modelling, analysis, measurement, improvement, and optimization.

Citizen Developers: Citizen developers are business users with little to no coding experience that build applications with IT-approved technology.

Clarivate Web of Science: World's largest publisher-neutral citation index and research platform.

Digital Transformation: A major change promoted by digital technologies in an organization's strategy and work systems, generating a reformulation of pre-established business models, creating better interactions with customers, and optimizing processes to produce favourable and sustainable financial outcomes.

Software Development Environment: An environment that automates or augments the routines involved in a software development cycle.

Visual Development: Visual development is the usage of a visual interface to create applications. The visual interface includes simple logic and drag-and-drop features, which makes the development process visual and more natural compared to traditional development via coding.

VOSViewer: A software tool for constructing and visualizing bibliometric networks. These can be constructed based on citation, bibliographic coupling, co-citation, or co-authorship relations.

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Chapter 26
Digital Transformation in Education:
Creating Lost Generation

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ABSTRACT

This chapter is divided into an introduction, where it shows the background and importance of digital transformation; a second section, which is a discussion of pandemics and school-home situations, and the third, which gives the implications of digital transformation. This chapter will discuss some factors that must be considered before implementing digital transformation in education. Individuals and societies are undergoing a multifaceted transformation due to the information era we are now experiencing. The ownership of knowledge has migrated, and conventional ways of teaching and learning are being replaced by new approaches. In today's environment, both the production and acquisition of information are essential. There is growing evidence that generating and utilizing information is crucial to the success of a person, an organization, or a society's prosperity. Society must undergo fundamental transformations because of the greater use and generation of information.

INTRODUCTION

COVID-19 epidemic, which broke out in early 2020 and has since spread over the globe, has altered the landscape of education. Since the advent of the virus, it has been abundantly apparent that youngsters fell more behind in their educational aspirations than before. Like Fore et al., 2021, several studies have shown that school cancellations caused by the pandemic are increasing "learning poverty," with the

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number of 10-year-olds who cannot read primary texts rising to over 70% in low-income nations as a result of the epidemic. Low and medium intensity. In the case of children who are in the age of compulsory schooling and who suffer a loss of learning activities, this might result in more losses in the future.

McKinsey and Company, a global management consulting group, issued an investigation in July 2021 which found that most students are four to five months behind in what they should be studying arithmetic and reading after the 2020-2021 school year (McKinsey, 2021). This lag occurred due to changes in learning methods due to the pandemic, from on-site to on-line. This change in learning methods is not without problems, because the on-site learning method that is guided directly by the teacher has changed to without a facilitator who accompanies students on the contrary, students become more independent.

During the pandemic, many schools were closed, due to government policies not allowing activities that involve large numbers of people. Government policies of countries in the world have given rise to a learning model that was not popular before, namely online learning. In a short time online learning was instituted by governments in countries around the world in early March 2020, with the aim of fighting the spread of the coronavirus, which was still in the early stages of developing a vaccine. There are about 150 countries where schools are closed completely, according to UNICEF (2021). However, there are actually a number of countries that still insist on implementing what is currently known as hybrid learning. About ten countries decided not to close schools entirely but closed some existing schools, and ten other countries decided to keep schools open as a whole, and as if things were still normal (Unicef, 2021).

According to Unicef (2021) records, beginning in March 2020, if it is determined that the situation relating to the transmission of the coronavirus is improving, nations that had previously implemented measures to suspend school activities will be permitted to reopen their doors. The converse is true: if the virus continues to spread, traditional classroom activities will be discontinued and replaced by online ones.

Regardless of how the government reacts to the epidemic, children must get an education of the highest possible quality. As a result, nations decided to enable schools to perform online learning models utilizing video conferencing services and (where applicable) e-learning during the early stages of the epidemic. The difficulty began when the government launched online learning because, according to reports, not all individuals in all nations throughout the globe can supply technology and facilities that are compatible with online learning environments. For example, according to data from the Indonesian Child Protection Commission (KPAI), the number of children who have dropped out of school has increased dramatically since January 2021, and this dropout rate is found among low-income communities is motivated by inability. Providing learning support facilities at the child's residence (yoursay, 2021). In this article, impediment became one of the themes covered, and there are still some issues been brought up as a result of this article, including some occurrences that occurred during the pandemic that affected the teaching and learning process of children, in several nations, including the United States.

BACKGROUND

World economies are being destroyed by the COVID-19 pandemic, causing havoc on the education system, both in developed and developing nations. The coronavirus outbreak is simultaneously causing widespread disruption in practically every aspect of school life (George et al., 2021). There is a shift from traditional classrooms to problematic computer screens in schools, which puts students' fundamental life principles, especially those relating to the quality of education, to the test.

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Parents around the nation are attempting to adjust to the fact that their children's learning environments are shifting compared to their regular daily routines, which is, of course, due to the COVID-19 outbreak. Most schools, public gathering places, and non-essential businesses are closed. Parents are forced to take on the role of teachers and assist children in learning at home to adjust to the new normal in life; this includes making every effort to keep children active and safe, as well as making every effort to stay up to date with educational developments as much as possible. Because parents are not qualified to be instructors, this scenario cannot be characterized as straightforward. At the very least, the children do not miss valuable learning time since there are still parents who may fill in for the role of the instructor.

Several reports display data on the number of students who are unable to carry out regular education programs due to the pandemic, leading to concerns about the declining quality of education during the pandemic; this is based on several sources occurring in the school environment, ranging from elementary school to university levels in Indonesia and around the world, including the United States. Interestingly, the pandemic's influence on education is felt not only by students but also by those in charge of educational institutions.

Education administrators feel the effects of the epidemic, as many parents have decided to put off sending their children to school because they are concerned that the fees they would pay will not be proportionate with the level of education they will be receiving. There are different responses from education managers to this. Education managers who have the financial means to do so will choose to invest in learning technology, whereas those who do not have solid financial capabilities will find it challenging to meet learning technology standards during a pandemic. For example, in the article published by Dickler (2020), the pandemic created an unclear scenario at the college level since various examples among colleges demonstrated financial problems during the pandemic.

The pandemic is seen as a shift in behavioral patterns. Even though conditions exist in the school environment in general and the management of education are described in the preceding paragraph, there are still social groups within the scope of education that are affected, such as children with disabilities who desperately need education but are unable to do so because of the pandemic conditions. -the right of children with impairments to get an education. Following the example of Schaeffer (2020), in Columbia, United States, where typically the services provided for children with disabilities follow the Disabilities Education Act (IDEA), which protects children with disabilities from being denied the right to free and ordinary education. Furthermore, the pandemic has placed restrictions on online learning, mainly since the practice of online learning during a pandemic is not simple to put into reality for students with disabilities, educational systems, and families who have impaired children.

COVID19 is often seen as the catalyst for the digital revolution, and this is especially true in education, as the digital revolution reveals itself when traditional learning processes are moved to the internet. Even though it is unavoidable for certain educational institutions, the practice of online learning is not a new phenomenon since it has been in use for many years prior to the outbreak of the pandemic. However, digitization has finally hastened the process for educational institutions that have not had the opportunity to put their theories into reality, although with certain limits. The fact is that governments in several nations are attempting to encourage online learning practices, including by providing stimuli for education participants in the form of different sorts of learning help. Examples include the American Rescue Plan, which is part of the stimulus package in the United States and will pay $122 billion to schools over three years as part of a three-year budget (Goldstein, 2022).

Digital transformation can improve students' learning experiences when appropriately done, as evidenced by the following features:

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1. Allowing students to register using mobile or online applications
2. Providing a variety of online learning options
3. Utilizing technology to track student progress
4. allowing teachers to build up online courses by providing them with the necessary tools and resources.

LITERATURE REVIEW

Digital Transformation

It is common to talk about digital transformation in the context of a company's or industry's cultural and organizational changes as well as its operational changes. I'm interested in developing solutions that will allow for the intelligent integration of technology, business processes, and digital skills at all levels and functions. This integration must be carried out in a systematic and staged manner. Sales, marketing, and customer service jobs that are no longer typical are challenged. In order to connect with stakeholders, it is necessary to have an empathetic mentality. It represents the beginning of a process of reinvention in the way businesses are conducted, with technology serving as a facilitator to reach this goal.

Vial (2019) conducts a survey of the literature that he believes would aid in the understanding of "Digital Transformation." Vial (2019) states in his study that there are 23 definitions of digital transformation, taken from 23 publications published between 2011 and 2017, and that from these 23 definitions, eight conceptual definition guidelines were developed, which were modified from Wacker (2004) and Suddaby (2010). The definition of digital transformation presented by Veldhoven and Vanthienen (2019) was drawn from 17 researchers (including those cited in Vial (2019)) and produced between 2004 and 2019. This led Veldhoven et al (2019) to conclude that the components of digital transformation are as follows: 1) use of new digital technologies, 2) new business models, 3) internal operations, 4) consumer experience, 5) social transformation, and 6) process optimization (Veldhoven et al., 2019). Afterwards, Veldhoven et al. (2019) proposed a definition of digital transformation as an interaction that takes place without a break between digital technology, business, and society, and that has a transformation effect while also increasing the speed with which the change process is carried out, its scope, and its environmental impact.

In addition to disruptive technologies and applications, digital transformation is dependent on a variety of factors. It focuses on value, people, optimization, and the capacity to react rapidly, while providing the best technologies to make it easier to achieve these objectives. In order to flow toward change and take advantage of new possibilities, it is a process that takes time and must be thoroughly integrated into the activities, processes, competences, and business models over time in order to be effective.

Learning Loss

In simpler terms, learning loss is the loss of academic information or abilities by students throughout their academic careers. There is a serious pitfall for educators and education policymakers to fall into: the learning loss. It is possible to fall into this trap if you have a vast quantity of data and advanced projection algorithms. It paints an alarmingly bleak image of education, and it encourages educators and policymakers to make poor judgments and waste their resources on ineffective initiatives. Moreover, as

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found in Huong et al (2020), learning loss refers to "any particular or general loss of information and abilities or to reversals in academic progress, most typically owing to lengthy gaps or discontinuities in a student's education".

To have a clearer understanding on what learning loss means, there are some research conducted in several years aim to reveal learning loss and helps us to understand its meaning. Fairchild et al (2002) describes learning loss as resulted from summer, and in specific courses, like mathematics and reading. However, years later, the update of similar case found, the amount of gain or loss a student had experienced throughout the previous academic year was the most reliable predictor of whether or not a student would experience summer gains or losses. To put it another way, the more children learned throughout the school year, the more probable it was that they would fall behind over the summer vacation (Kuhfeld, 2019). Then in recent finding, for example Donnelly et al (2021) highlight learning loss as resulted from pandemic, by doing a comprehensive study of recorded learning loss data that was documented between March 2020 and March 2021, where some categories of pupils had learning losses more substantial than others.

DISCUSSION

Pandemic and School from Home Situation

The Covid-19 epidemic has had a particularly negative impact on the education sector. In order to control the spread, the authorities implemented restrictions on movement or a lockdown in each nation affected. In order to ensure that students and youngsters study from home utilizing digital technology equipment, the teaching and learning process is carried out at their residences. From kindergarten to higher education, educational institutions are compelled to employ online learning, watch professors lecture in video mode, complete assignments by scanning them, and submit the images they capture. Most tasks are transformed into forums or debates; students are required to create short films as evidence and use more than one device to guarantee that they do not cheat while taking the test.

Adaptation to this disturbance is also required for the professors and lecturers. Many professors are older citizens who understand that standing in front of the class and presenting the subject is the only proper technique. Talking to monitors while facing pupils in front of a dark screen is uncomfortable, but it has to be done. Education institutions are also experiencing difficulties in synchronizing the teaching and learning methods. The majority of them are entirely unfamiliar with the concept of an online application, much alone an instructional platform. It is relatively uncommon for nations to lack adequate internet and network access. Some organizations have not made the necessary investments in the server and digital education platform backbone, and as a result, they do not have enough storage space for the material, which is mostly in video format. It is also a source of nightmares for parents. They also work from home and are compelled to split their time between education and their jobs and family obligations. Focus and attention issues are the most prevalent since youngsters are used to engaging in other activities rather than watching their instructors on a computer screen.

During COVID-19, the Organization for Economic Cooperation and Development (OECD) presented a paper that said that home-schooling and a growing reliance on virtual classrooms would likely have a long-term effect, particularly on impoverished pupils. According to the United Nations, pandemic-related school closures will impact 90 percent of the world's student population, which is equal to 1.57

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billion people (Unesco Fact Sheet, 2021). The research discussed several difficulties, including the fact that youngsters lost 54 percent of their contact time in one year, as of November 2020, which equates to more than a year of learning loss, not to mention the loss of previously acquired information. As a result of the epidemic, around 40% of low- and lower-middle-income nations cannot assist learners, particularly those who live in distant locations, are impoverished, are members of linguistic minorities, or have impairments.

The options for remote or online learning vary from converting paper-based materials to file-based materials when delivering the topics to leveraging broadcast media (such as radio and television) and digital platforms to combining these methods (such as google meet, zoom, teams, et cetera). Radio was the most widely used medium in low-income nations (92 percent), while it was the least widely used media in high-income countries (48 percent) (25 percent). In contrast, according to data from the UNESCO Institute of Statistics (UIS) and the Teacher Task Force, over 826 million pupils do not have access to a computer at home (Unesco, 2020). For many youngsters, the transition to digital and online learning is a significant obstacle to overcome in this environment.

According to the International Education Fund, access to the use of computers was increased in 49 percent of nations to assist the pre-primary, primary, and secondary levels. It will impact the nations' ability to boost their education budgets in the next two years and devote more resources to marginal learners and people with impairments. The pandemic issue has a more significant influence on the yearly gap between low- and lower-middle-income nations in terms of achieving SDG4, which improves the quality of education.

Examples from Several Countries

Indonesia

However, during a pandemic, more youngsters drop out of school than usual. According to the Indonesian Child Protection Commission (KPAI), a non-governmental organization, the number of children who drop out of school has climbed drastically between January and December. Children from low-income homes are disproportionately affected by this dropout rate. Children who dropped out of school because of the epidemic were found to have five characteristics:

1. **Students drop out of education as a result of their marriage:** Pupils from Seluma, Bengkulu City, and Bima districts were among those who dropped out of school due to marriage. On average, students who get married are in class XII, which is only a few months before the school's last examination before they graduate. Because they are still students at PJJ, most of them get married without the school's knowledge. Because he had never engaged in PJJ again, the homeroom teacher or Counseling Guidance (BK) teacher only learned about it after the school administration conducted a "home visit" on him. The number 33 at the start of 2021 is considerable. As a result of the supervision of face-to-face school preparation in 2020, data on the dropout rate reached 119 cases, with the areas covered by the study including Bima, West Sumbawa province, Dompu, West Lombok, East Lombok, North Lombok, Mataram city, Bengkulu city, Seluma, Wonogiri, Jepara, and Bandung province.
2. **Students drop out of school as a result of their jobs:** Some vocational and junior high school students were compelled to work in the aftermath of the epidemic since their families could not

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support them. As a result, the kid must contribute to the family's economic well-being. In Cimahi, one junior high school student works as a construction worker to support his family's economic situation. In addition, one student in Jakarta who works in printing assists his parents' firm, which has suffered from a lack of personnel due to the epidemic and a lack of print orders.

3. **Students drop out of school because they cannot pay their tuition fees:** Many students will be unable to pay their tuition from the beginning epidemic in March 2020 to the end of the semester in February 2021. Private institutions account for over 90 percent of instances, with high schools and vocational schools accounting for 75 percent of all cases. The late payments resulted from the pandemic's influence on the family's income, which was interrupted. It was difficult for the parents to fulfill their financial obligations, so they decided to scarify their children's school tuition. The students said that they did not pay their tuition for an average of 6-11 months. Because the public school was free, there was no concern about paying tuition. However, parents' monthly payments would be reduced since private schools were also impacted by the backlog and would send reduced payment of installments to parents. However, since there is no money to pay for anything, many parents choose to have their children released from school.
4. **Compulsive player of online gaming:** Another observation came from the city of Cimahi, which is located in the province of West Java. Twenty-seven junior high school kids dropped out of school because they were hooked to online games, with one of them taking a one-year leave of absence to focus on his or her psychological rehabilitation. In addition, reports from instructors in various locations reveal a surprising fact: students who did not present at online PJJ in the morning were still sleeping since they had been playing online games till the wee hours of the morning.
5. **A student passes away:** A student who died after being swept away by the current during the flood disaster in Bima Regency last January, also one of Jakarta's private vocational schools who died after being involved in a motorcycle accident, was among those who were observed dropping out of school as a result of death.

Australia

Another example comes from the country of Australia. The problem is that young people are in danger of being directed into low-skilled employment and low-paying in nature. There are socioeconomic fault lines in Australia's education system due to the disruption of learning caused by the coronavirus epidemic, which is thought to be degrading the overall quality of education in the country.

Every school system in Australia was compelled to implement periods of home teaching, with students often spending days or weeks speaking with their instructors and schoolmates using Zoom or other similar online systems. A new closure has just ended, and schoolchildren and their parents in Melbourne have just emerged from it. In a study on the skills base of member countries, the Organization for Economic Cooperation and Development (OECD) said that even before the pandemic, there were significant differences between pupils from low-income homes and those from middle- and high-income families.

After completing compulsory education, children from poorer socioeconomic origins were less likely to continue their studies, were less likely to pursue post-secondary training, and were more likely to choose jobs with restricted prospects. Divides have become worse due to the changes in training and education brought about by COVID-19 (OECD, 2022).

"Many young people, especially those from socioeconomically challenged families, may choose to leave school before completing their education. Additionally, vocational education and training supply

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disruptions have occurred, and labor market contractions have reduced possibilities for skill growth while employed. "It was discovered.

As a result of altering the way higher education and formal courses are offered, growing financial limitations on families, and rising uncertainty, the pandemic poses a significant danger of generating a lost generation.

According to the research findings, despite massive expenditures in education made by state and federal governments since 2000, there has been a minor increase in literacy among kids from poor socioeconomic backgrounds in Australia. At 25, just 14 percent of pupils in the lowest fourth of the reading proficiency scale were in skilled employment. At 25, over half of pupils in the top quarter of their classes were in skilled employment.

There was a 51-percentage point disparity between the number of students in the poorest quartile for literacy and those in the top quartile who obtained a university degree in Australia, making it the country with the most significant difference. According to the findings over the preceding two decades, there has been no progress in reading skills among the worst quarter of kids in either Australia or Canada. According to the findings of a recent study, students who loved reading will outperform their peers when their parents had a higher degree; this resulted in enhanced reading results, which in turn resulted in increased continuous skill levels as they grew into adulthood.

Angie Tawadros, Sydney's mother and lawyer, has two children under the age of five and has been reading to Joseph, who has been four years old since he was a baby.

"I had read in several sources that reading to your children was beneficial to them and would set them up for a lifetime of enjoyment of reading," she said. "I decided to try it." "It is significant because it opens their eyes to the vastness of the world around them. It also serves as an escape from the stresses of daily life and encourages them to engage their creativity."

Mrs. Tawadros has discovered that reading to her kid has been beneficial in determining his interests. "Joseph has a strong interest in space, which we would not have discovered if we had not read him a variety of books on the subject."

A noteworthy finding of the research was that immigrant parents were very concerned with ensuring that their children performed well in school. In countries such as Australia, Belgium, Canada, Germany, and Denmark, children of immigrants outperformed their peers born in the country. "This shows that, after the academic achievement is taken into account, immigrant students' greater expectations may be a reflection of their more positive views and personal characteristics," the study concluded.

Ethiopia

The pandemic Covid-19 posed a threat to student learning in other countries such as Ethiopia, where schools were compelled to shut as a precautionary measure to control the virus. The lockdown policy impacts every part of the higher education system (Yang, 2020). For example, many face-to-face teaching and learning activities in higher education are prohibited, and many university faculty positions are in jeopardy. Education at the postsecondary level in Ethiopia is still in its infancy. Ethiopian higher education began in 1950 with little experience, and the country's progress has been significantly constrained until the twenty-first century, according to Abebaw (2014).

According to a study conducted by Mengistie (2021), neither Ethiopia's government nor its institutions made active steps to ensure that undergraduate students' learning was sustained. Graduate and Ph.D. education in universities was suspended until May 2020, and many have questioned the quality

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of graduate and Ph.D. education that would be continued via online learning. The enrollment rate for students from Sub-Saharan Africa is one of the lowest globally, at around 5 percent (Bloom, Canning, & Kevin, 2006, United States Agency for International Development [USAID], 2014). Higher education is inadequately structured and coordinated, and it has the least amount of research and technical assistance of any country in the world. The institutions were confronted with the problem of delivering students' learning via cutting-edge technology. When the pandemic strikes, the schools do not have the necessary technology to provide online teaching and learning for their undergraduate and graduate students.

Ethiopia has 45 public universities, with the vast majority of them located in regional districts. There is at least one higher education institution in each of the nine areas. Even though the university has desktop computers in the classrooms and library, students do not have access to or utilize technology in their educational endeavors. Students may choose from various options, including regular, summer, and remote learning. The majority of the pupils are from rural regions with a strong agricultural background. Students with laptops or desktop computers are in the minority and tend to come from wealthy metropolitan backgrounds.

Teachers at Ethiopian universities are challenged by a lack of technological input and competence, and technology application rates in Ethiopian institutions are among the lowest in the world. The vast majority of teachers do not have access to the internet at their residence.

The kids are likewise dealing with issues of their own. The family lives in poverty and relies on various activities to make ends meet. During the summer, kids lend a hand to their families to create revenue, which affects student participation in university activities during the off-semester period. Only a small number of kids from urban homes participate in campus activities such as student councils and contests. Families cannot buy a laptop or a smartphone due to financial constraints. The power might be out for extended periods, causing the internet connection and network to be disrupted. There is a significant expense associated with internet connection use. When the pandemic strikes and online schooling is implemented, most students attend the online class by smartphone, despite their limited capacity to access and utilize technology to aid in their educational endeavors.

Since the beginning of 2020, the spread of the Covid-19 virus has caused significant disruption in higher education, posing a challenge to the communities of the schools and posing a danger to the economy's overall security and stability (Bhagat & Kim, 2020; Currie et al., 2020; Mohammed et al., 2020).

SOLUTIONS AND RECOMMENDATIONS

Solutions

In order to prevent children from becoming part of the lost generation, Unicef (2020) asks for six action plans: the first is to guarantee that all children have access to education by bridging the digital gap. It has been over two years since the pandemic crisis began, and the long-term effect on children and young people as a result of the interruption of critical services and the socio-economic ramifications have yet to be determined. It seemed that narrowing the digital gap might be accomplished via community-based social activities and initiatives. Families with additional devices may give their extras to families that do not have any so that youngsters can continue to study from the comfort of their own homes. Second, ensure that every kid has access to health and nutrition services and vaccines that are inexpensive and readily accessible. Because the Sustainable Development Goals commitment is to "Leave No One Be-

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hind," activities must target the most disadvantaged children and young people, including females, those who are poor, excluded, or subjected to violence, as well as those who are in a refugee situation. In the third place, support and preserve the mental health of children and young people while also putting an end to abuse, gender-based violence, and neglect throughout childhood.

The following four priorities are increasing access to safe drinking water, sanitation, and hygiene while addressing environmental degradation and climate change. The fifth priority is to halt the increase in child poverty and achieve an inclusive recovery for everyone. The sixth priority is to redouble efforts to safeguard and assist children and their families who have been affected by war, catastrophe, or displacement.

Recommendations

We can see that the pandemic may be simply one sort of disruption for the long-term sustainability of the teaching and learning process in education as a whole. Online learning may be an excellent substitute in certain situations, but in this instance, individuals have no other option but to continue their education via the internet and digital platforms. Thus, the advice will be broken into two parts: technology and attitude and behavior, discussed separately.

Technology

Khan et al. (2020) proposed a cloud-based educational model for an alternative during a lockdown situation. The cloud-based can generally operate under a crisis such as a lockdown, pandemic, war, or remote areas. The support is provided by automated chatting capabilities automated response systems to ensure excellent communication between teachers and students during the teaching and learning process. The technology of machine translation also can be used with automated response systems, chatbots with sentiment analysis capabilities (Astya, 2017), digital images (Bashir, 2017), and big data (Khan, 2019). Moreover, machine learning is enhanced to function the statistical topics (Shahnawaz, 2013), case-based reasoning technique, rule-based methods, and artificial neural network (Khan, 2011). Machine learning can also be developed to analyze user satisfaction (Rabbani, 2016), enriched with the capabilities of teaching finance subjects by integrating with blockchain and financial products (Rabbani 2020).

Mindset and Behavior

- **Parents:** Parents face challenges when the school transfers to home due to the school closing. Based on study of Garbe, Ogurlu, Logan and Cook (2020), the biggest challenges that parents must face are balancing responsibilities, non-positive learner motivations, accessibility, and learning outcomes (Table 1).

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Table 1. Parents challenges with online learning (Garbe et al., 2020)

Parents Struggles With Remote Learning		
What is your biggest challenge?	Frequency	Percentages
Balancing Responsibilities	**72**	**41.1**
Balancing parent employment demands and learner needs	44	25.1
Balancing multiple levels of learners in home	12	6.8
Personal balance	7	4
Parent feels overwhelmed	9	5.1
Non-positive Learner Motivation	**31**	**17.7**
Lack of learner motivation specifically related to remote learning	17	9.7
Lack of learner motivation not specifically related to remote learning	14	8
Accessibility	**39**	**22.2**
Learner special needs	13	7.4
Lack of access to technology hardware or internet quality	7	4
Lack of online resource organization	2	1.1
Lack of parent content knowledge or pedagogy	9	5.1
Need for teacher communication	8	4.5
Learning Outcomes	**29**	**16.5**
Academic progress	7	4
Curriculum concern of parents	14	8
Socio-emotional development concern	8	4.5
Outliers	**5**	2.8
No Struggle	3	1.7
Significant Toll	2	1.1
TOTAL	175	100

The recommendation from this study (Garber et al, 2020) is to understand the limit of home lives and concerns that parents are experiencing and work to meet the needs of each family. It is similar with building relationship with each student. Building online learning communities is as important as building in physical class. The online learning should also be interactive, flexible, and supportive, including the parents. The educators should be able to differentiate their practice to different types of families. Some of them needs struggles, some of them find no struggles at all. This type of understanding might increase the success rate for students in achieving their learning outcomes. The parents also need to adapt when the school is open again.

- **Student:** Students might find the online learning while doing school from home is more acceptable than parents and teachers. Some students like to stay at home because they do not have to do morning routine such as take a bath or having breakfast and going to school. Some students might find it boring after few weeks staying at home and can not go anywhere due to the lockdown. This is inline based on the study done by Keaton and Gilbert (2020), that says growth on online education could benefit many students who have marginalized or having unique situations that needs flexibility or living in remote areas. The students can access the difficult subjects such as medical, law, dentist, nurse by at physical school, but learning the theories using online platform.

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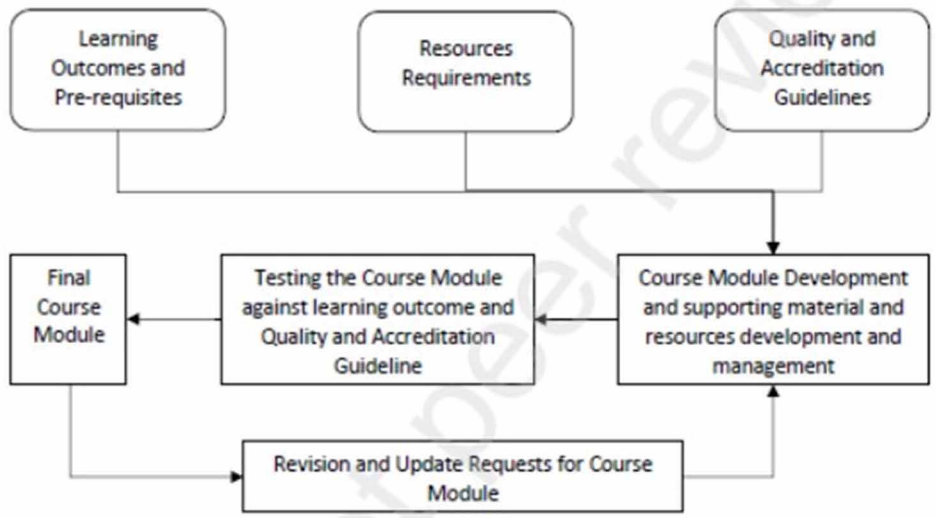
FUTURE RESEARCH DIRECTIONS

The distance learning providing by the online might be strong alternatives that the world learnt to continue the education process during pandemic. As the fact shown that people adapt the online learning and accept it as habitual situation, enhance further ability the online learning reach out marginalized students and those who live in remote areas. The future research can be aimed to study these possibilities with combining advance automated online learning. Other study might be aimed to how to create contents to deliver difficult subjects such as math, statistic, accounting, or finance, requiring laboratory, languages, and others.

Figure 1. Advance Online-Learning Process (Khan et al., 2020)



Figure 2. Content Development Process (Khan et al., 2020)



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Figure 3. Cloud based and Virtual Laboratory Online Learning (Khan et al., 2020)



CONCLUSION

The book chapter is to examine the online learning dealing with the education crisis due to pandemic Covid-19. The chapter concludes that the online learning is the only way to answer the discontinuing learning process due to lockdown situation. The covid-19 pandemic has immensely brought a disaster to the humankind, but crisis can open new possibilities and opportunities to other thing. The examples of some countries above give insights on how different they may react; however, they will do the best based on their own resources and existing capabilities to make sure the education process would go as smooth as possible during the pandemic.

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Chapter 27
A Comprehensive Study on Gesture Detection:
An Approach for Sign Language Interpretation Analysis

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ABSTRACT

The advent of technologies made our lives more comfortable with their rapid spread in various sectors like business, education, productive industry, marketing, health sector, and many more. Computer vision being an interdisciplinary field has a large scope of applications, and among them, object detection carries a vital role and has wide spread in various fields of study. Object detection exhibits a potentiality in numerous applications like image and video annotation, gesture detection, etc. In this regard, a preliminary research is carried out on sign language gesture recognition to review and facilitate the road map of earlier research findings. The work is carried with a focus on the recent developments and the enormous techniques and tools that were introduced to handle gesture recognition varying from mathematical models to deep learning models with its advantages and limitations. Issues like computational complexity and accuracy with respect to the various verticals of the sign language interpretation are explored and are listed with their remarkable outcomes.

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INTRODUCTION

Computer Vision is a branch of Artificial Intelligence that is used to extend the visual ability of the machines so that they can interpret the input data and recognize them. Generally, one can think about how easily a human eye can capture the scene and interpret its essence. For a machine to interpret the same, it should learn to mimic the human brain. Though it turns out to be easy in the case of human learning, there are years of evolutionary context that assists the human to visualize and understand the captured data. To replicate the same in computers the researchers have come out with plenty of techniques. To some extent the traditional image processing techniques like classification, segmentation, filtering etc would help to understand or interpret the images. However the image processing techniques alone cannot make machines learn as humans. An extension of visual capability and evolutionary context setup is required to do so, which can be achieved through Computer Vision (CV) and Machine learning techniques.

The big challenge for computer vision techniques lies in training the machines to truly mimic the human brain which needs an incredibly large amount of data, millions of objects in thousands of angles. In order to attain this, CV techniques supply a suite of algorithms to the machine where they can take advantage of visualizing the data just as a big array of integers that represents intensity levels of the image. With the use of these algorithms the machines are trained to understand effectively what that specific arrangement of numbers will represent. Sometimes there are situations where the human eye cannot differentiate the similar images properly. But whereas machine learning provided with enough data and training is eventually capable of identifying and differentiating them easily. Computer Vision handles more complex challenges by incorporating image processing techniques extended with deep learning. The main idea behind is instead of working on raw images captured from a sensor, it operates on processed images to attain high accuracy. Various fields expanded their automation with the rapid application of Computer Vision techniques. Most popular applications are Manufacturing, Medical Science, Recognition, Surveillance, Agriculture, Retail etc. In the manufacturing industry the fault detection of the machinery can be done with the robots which are equipped with the CV techniques. In a similar way, a lot of medical history is available these days and can be properly inferred and interpreted using CV techniques. This interpretation would help the medical community to better assist the society by means of early and accurate detection of disease level, prediction of future diseases etc. Another field of application is surveillance, in which live footage of the public can be processed to identify harmful objects and thus helps the society to control crime, theft and to maintain law and order etc. To meet all such requirements, sub disciplines such as Object Recognition, Image Colorization, 3D Reconstruction, Image Synthesis etc are built on the top of the computer vision techniques. As the scope of this work mainly relies on object detection and sign language interpretations, the earlier research findings and their future scope is presented in detail below.

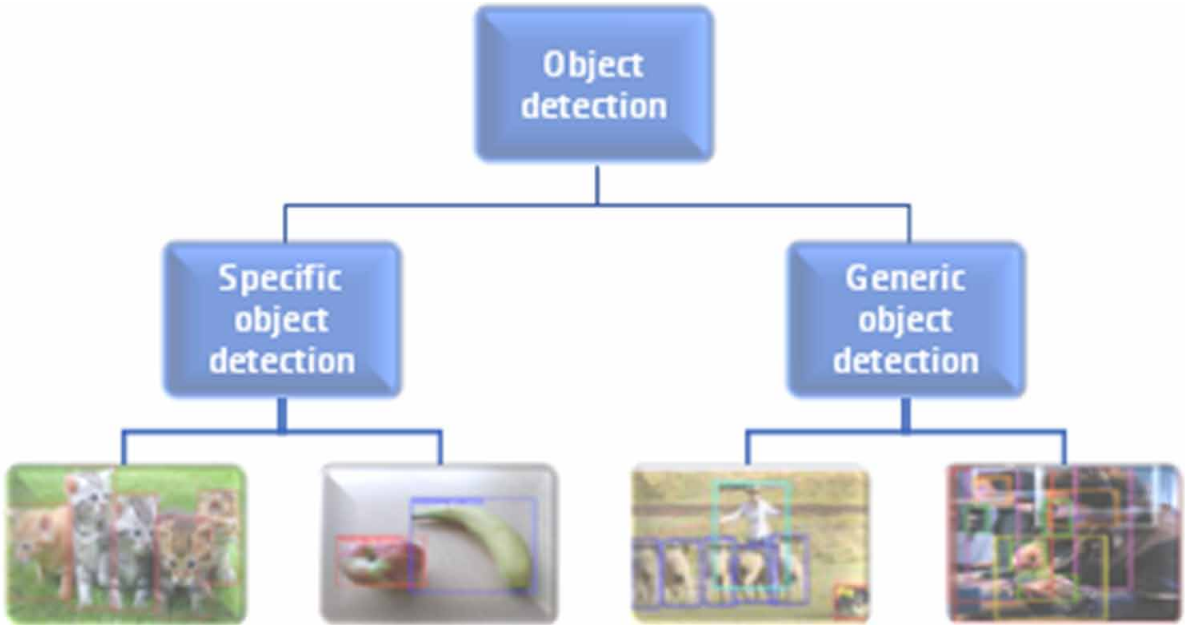
Object Detection

Object detection is one of the challenging problems built on the top of the Computer Vision techniques, which aims to find object locations or instances from predefined image categories. In order to do so, the spatial and boundary coordinates of the objects are located to determine their extent and instances of various categories like human, animals or things. So understanding the image from object detection and computer vision serves the purpose of solving various simple to complex vision based problems (Rastgoo, Kiani, and Escalera, 2020). However, for building such a system, it needs an information exchange and

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more interaction between computers and the physical world. This concept has attained much attention with the research in the area of human computer interaction (Borji et al., 2019). According to (Liu et al., 2020) object detection can be categorized into two groups viz., 1. Specific instance detection and 2. Generic instance detection. The first category aims to detect a particular object instance (such as Narendra Modi face, Tajmahal, or a cat). This kind of detection is essential and helpful in match problems. The second category tries to detect previously unseen object instances of the predefined categories of images. The categorization of the detection techniques is depicted in figure (1).

Figure 1. Categorization of Object detection



The past research has been focused on both specific object instance detection and generic object instance detection. Historically, more effort is observed in detection of objects belonging to a single image category. However, the evolution of deep learning techniques facilitated the researchers to take more challenges in building models for detecting generic object instances which actually occupy vast image categories. This journey towards real time applications of object detection has raised a few more key challenges (Zaidi et al., 2021). Intra class distance, identification of object categories with their efficiency and the other influencing parameters of object appearance like occlusion (Sharma et al., 2021), view angle, hand pose (Doosti, 2019; Li et al., 2019; Ge et al., 2018), illumination that could probably result in variations among the instances during the process of detection. The careful handling of these parameters results in high quality image annotation which is one of the important parameters in training the model for its interpretation. This high demand for clear interpretation of the image insisted on the evolution of Convolutional Neural Networks (CNN) (Köpüklü et al., 2019). Many CNN based architectures have been evolved for image interpretation. This kind of image processing using multiple convolutional kernels along with the activation layers helps to easily proceed with the feature extraction, regularization and quick convergence.

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In the same context, the introduction of AlexNet (Krizhevsky et al., 2012) has shown a remarkable effort in the area of image classification. It is architecture of 8 layers with 5 convolution and 3 fully connected layers. The two drop out layers prevent the network from overfitting, and an activation function (Kundra et al., 2019) helps the network to learn complex patterns using 62.3 million parameters. Another network namely VGGNet was developed with more convolutional layers and dropout layers for large scale image recognition. Its stack of layers architecture with extended learning power made it a backbone for object detection and classification models. These initial models are resource intensive and so suffer with certain related limitations. GoogleNet (Garcia and Viesca, 2016; Szegedy et al., 2015) addressed these issues related to resources-based limitations. There are many more extensions to the basic convolution networks namely Recurrent CNN, Fast CNN, ResNet (Alawwad et al., 2021; He et al., 2016; Szegedy et al., 2017) etc. that has evolved to work with millions of parameters of large databases for visual object detection. An extended Deep CNN are evolved and experimented with various parameters in DenseNet (Huang et al., 2017). Various backbone networks of CNN such as VGG (Simonyan and Zisserman, 2015), Inception (Szegedy et al., 2015, 2016), ResNet (He et al., 2016), ResNeXt (Xie et al., 2017), and Xception (Chollet, 2017) etc.

Gesture Recognition

Gesture recognition is a subdiscipline of object detection which has attained its identity in language technology whose goal is to perform human gesture interpretation with various mathematical algorithms. Gesture recognition can be considered as a tool to interpret the human body language and bridge communication among machines and the human world. Human bodily motion or state conveys gestures but usually gestures conveyed through face and hands grab more attention with their place in emotion recognition, touchless interfaces development etc. Computer vision and image processing techniques are the main contributors to gesture recognition where they provide a platform to facilitate the user to have a control or interact with the devices using simple gestures. These approaches are proven to be highly accurate, stable and time saving for many HCI applications. Number of implementations are introduced in image/video-based gesture recognition and are varied in accordance with the tools used to capture the input. Large amounts of research has resulted in input capturing tools like wired gloves, depth aware cameras, gesture based controllers etc. Especially when it comes to visual based sensors, more robust CV techniques are in high demand. Gesture recognition is also associated with challenges related to accuracy and usage related aspects. The equipment used to capture the input will be sensitive to the noise and has to be carefully addressed. The capturing is also sensitive to location and lightning conditions. However, the proper attention to these challenges has given a place for gesture recognition technology in many applications. The major applications of gesture recognition includes gaming, consumer electronics, smart devices, defense control, home automation, automatic sign language interpretation and many more. The scope of this survey is mainly concentrated on sign language recognition and is detailed in the section below.

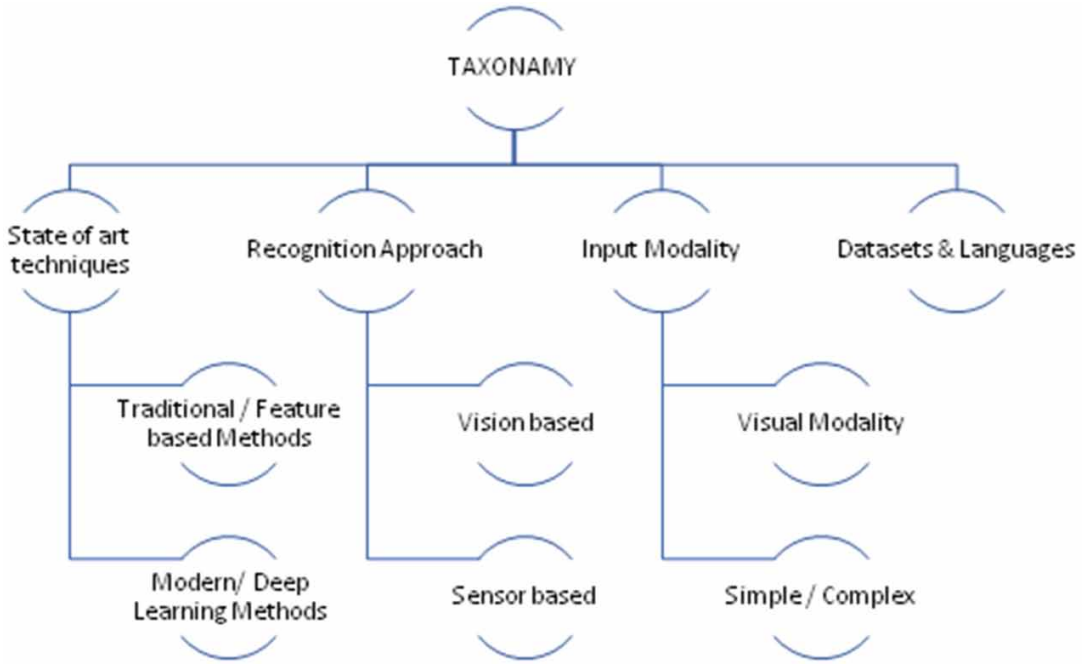
Sign Language Recognition (SLR)

Technology innovations have amalgamated into various aspects of our lives, and health care systems is one among them. Though the advancements in the medical field have enhanced the human life style and quality of their living, yet there is a need to integrate them in communities like the physically disabled.

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There are many challenges in the disabled community that are to be addressed to assist them. Research in this direction emerged with innovations to help the disabled with technology aids like Braille, Smart Wheel Chair, speech and hearing aids, assistive eating aids and many more. Communication is an effective way to express our feelings, thoughts, and opinions to the outer world. Inability to communicate in dumb people significantly affects them in handling the daily challenges, hindering the quality of their life. Imparting technology to open finer routines would assist them a lot. All in all, people with speech disorder use gestures to communicate. Interpreting and translating these gestures into speech eases their communication. In order to address this issue, arriving at a speech generation model is an apt solution. However, building such a model involves generating speech from the sign language gestures which has very complex data processing. To accomplish this, sign language interpretation can be achieved through traditional and modern deep learning methods. In the traditional approach where gestures are more of conveyed through hand postures (Tang et al., 2015), features are extracted from gestured images to segment the hand object and classify it to interpret the gesture. Whereas in deep learning methods, models are built by training them to learn the gestures and interpret them. The advent of neural networks facilitates extensive training letting the possibility of wrong interpretation very minimal. A substantial study of state of art techniques for gesture recognition and interpretation is furnished in the following sections to understand the pitfalls and come up with a whole picture of the existing gesture recognition models. The basic taxonomy of sign language recognition is depicted in figure 2.

Figure 2. Taxonomy of Sign Language Recognition



The identified gap analysis through our study motivated to present a comprehensive analysis and obtain a quick road map with an emphasis on gesture image classification for understanding the sign language which is detailed in the following sections.

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TAXONOMY OF SLR

State of the Art Techniques

Sign language recognition is one of the applications in human gesture interpretation. Evolution of sign language recognition began with traditional feature extraction methods and has been extended with the advent of the modern deep learning and hybrid learning methods. The former approach basically works on the principle of segmented feature extraction and classifies the images using either supervised or unsupervised techniques. The second approach concentrates on convoluting the features of the input image in order to classify the image label. The hybrid learning model (Koller et al., 2018) is a combination of these approaches to result in better convergence for the process of image classification.

Traditional or Feature-based Techniques

Over the years researchers have come up with plenty of techniques to acquire and analyze the data for gesture recognition. These techniques were designed with an aim of dealing with various spatial and temporal features of the gestures. Specifically, when it comes to the hand gestures of sign language recognition it has to consider various parameters like hand shape, position, motion, color and depth (Guo et al., 2017) etc. All the parameters have been dealt separately with different modality levels. However, the basic underlying working process of the traditional techniques majorly involves the feature extraction and its analysis.

A traditional gesture recognition process involves a few stages such as acquiring the data, preprocessing, identifying the region of interest (ROI) (Hyma et al., 2016), segmenting the ROI, extracting features from the segmented region. These extracted features are given as input to the trained gesture classification model to label the gestures as depicted in the flowchart figure 3.

Modern or Deep Learning-based Techniques

The recent advancements of deep learning techniques facilitate a wonderful experience that significantly grabs more attention from the research community. The challenges faced due to the usage of traditional approaches in the computer vision applications like gesture recognition can be easily outperformed by these automatic learning processes.

In GR the overhead incurred in traditional approaches of building and extracting features of the input data can be circumvented with the use of deep learning models. The inbuilt convolutionary mechanism allows multiple layer processing to learn and pool the features to a level of abstraction that recognizes the gestures. All the effort made in imitating the human learning mechanism helps in resolving the complex input structures. As depicted in figure 4, Neural networks act as backbone for deep learning, they recognize image patterns by learning, hence it can be understood that sign language gesture recognition can be achieved accurately by neural networks with extensive training. Researchers have worked in this aspect to build and train models using neural networks. Analysis of various models has been provided in this paper to understand their recognizing capabilities and limitations for various sign languages.

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Hybrid Techniques

An improved accuracy and efficient processing of the input images can be performed by combining the traditional techniques with the modern deep learning techniques. The strong discriminative qualities of CNN and sequence modelling of traditional approaches, when fused together addresses the challenges that may encounter in individual approaches. This is notified in earlier work (Chen et al., 2018) where automatic feature extraction is performed using CNN techniques and SVM- a traditional approach is used for final classification. Their experimental evaluation using hybrid approach confirmed the higher accuracy than the single approach. In a similar way another hybridization of CNN-HMM is observed in sign language recognition. Better performance is witnessed by embedding CNN into an HMM environment for continuous sign language detection (Koller et al., 2018).The decrease in error rate and better performance made visible results to proceed with the hybridization process. Combination of CNN and Histogram of Cumulative Magnitudes (HCM) is proposed in (Cardenas and Chavez, 2020) where input modalities are the main concern to handle the keyframes from the input video. The process is depicted in figure (5)

Recognition Approach

Human gestures are generally conveyed using various body parts like hands, head, arms, upper body. There exists a suite of recognition techniques that handles each of these conveying mechanisms with their pros and cons. The research work carried so far has witnessed that the hand posture technique has grabbed major attention towards sign language recognition. This gesture recognition varies in accordance with the way of capturing the input data which led to the categorization of vision based and sensor-based approaches (Chen et al., 2020). To be more specific, based on the image acquisition (Mani and Bhaskari, 2014) approach and its analysis involves various complexity levels due to the parameters such as hand shape, movement, position, orientation, etc.

Vision Based

Vision based gesture recognition has drawn its roots from computer vision and image processing. This approach mainly focuses on feature extraction from the estimation of the hand shape and position, region of interest based segmentation of the gestures, contour, edges, color. Input data is acquired either in the form of images or video through the capturing devices which when passed through the designing model recognizes simple or complex gestures. But a major challenge is the increase in the gesture base with various transition movements of the user signs and their wrong classification negatively impacts the accuracy of the vision based approaches.

Sensor Based

Sensor based gesture recognition relies on the electronic instruments worn by the subjects to acquire the position, motion, shape, orientation of their hands. These approaches eliminate the overhead of preprocessing, segmentation, feature extraction stages which are requisite in vision based approaches. The devices used for data acquisition are gloves or probes with sensors, electromyography sensors, flex sensors, wifi and radars, etc. The features like finger position, angle, transition movement, etc are

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extracted from the sensor devices and given as input to the gesture recognition model. Though there are many advantages, the laboratory setup with the physical devices like gloves and sensors are required prior to the gesture recognition that often limits its usage. Hence vision based approach using cameras is more appealing in deep learning models for gesture recognition.

Data Modality

Data modality implies various types of information associated with the targeted domain. For example, in a particular field of study like remote sensing, the data acquisition (Mani and Bhaskari, 2018) includes multispectral images with multiple modalities like color, frequency, depth, etc. Various modalities impact the output at different levels, hence, there is a need to analyze the weight of each modality to improve the performance. As a consequent step, it leads to a data fusion process that combines different modalities to improve the decision making process.

Visual Modality

Over the years various visual modalities like RGB, depth, thermal, skeletal and other modalities have been studied in the area of gesture recognition. With a focus on vision based approaches, RGB and depth are familiar modalities in sign language recognition. The flow of information- optical flow and scene flow, is another visual modality that has been used widely in the analysis of sequence of video frames. Enormous number of techniques have been developed to deal with the corresponding modalities and two or more modalities are combined for better accuracy. Capturing devices that are being used to acquire the input is another major concern in the visual modality. According to the device to go with and the chosen models to work with, the information can be recorded in 2D or 3D. A 3D representation model is preferred to avoid the ambiguity problems like occlusion that exists in 2D that are detailed below.

Simple/Complex

Recognition models used to analyze and identify the gestures also depend on various input forms viz., simple and complex. The simple form of the data corresponds to the static representation of the input that could be still images which convey words. On the other hand the complex input form is a sequence of frames or an input video that convey information at sentence level. This form of representation goes through the techniques of isolation and tokenization in order to get proper sequence of synonyms of a sentence. In sign language recognition the learning models should have the capability to generate a meaningful sentence from the subject gestures. Each of the learning models is targeted to work with a particular form of input, and these models can be fused to form a multimodal system to work with different forms of the data simultaneously. Thus, a multimodal system is a final path way to handle continuous gesture data and outperform with an improved accuracy (Duan et al., 2016).

Datasets and Languages

Immense databases are available for human pose detection (Zimmermann eand Brox, 2017), but it is not the case for gesture databases of sign language recognition. Though available with a low volume, solid witness of standardization is missing in terms of accurate annotation. This absence would lead to

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misinterpretation by the learning models. As the performance of the vision based approaches which are considered to be more familiar in sign language recognition are highly influential and also sensitive to the data corpus raises an immense need of standardization.

Sign corpus is constructed in accordance with the chosen sign language to work with- like American sign language (ASL), Arabic sign language (ArSL), Indian Sign language (ISL) (Kumar et al., 2017), German sign language (GSL), Chinese sign language (CSL), etc.

A COMPREHENSIVE SURVEY OF SLR TECHNIQUES

Hidden Markov Model (HMM) is a mathematical model which helps to predict an output based on some observed factors. For example, predicting the condition of the weather based on the clothing of a person, gene sequence analysis, gene prediction. HMM is being used as a very initial Gesture recognition technique from 1990's out rating even the newly developed techniques with high efficiency. This model takes parameters from different input devices for recognizing the gesture. In "Hidden Markov Models for Gesture Recognition", the author (Tanguay, 1995) came up with an approach specific to the domain using the statistical HMM model in 1995. It was a double stochastic process to identify the transition of movements in the process of gesture recognition. In this approach four features related to scaling, position and velocity components are extracted in the form of a vector. A codebook is constructed by modified K-means clustering and estimation from the obtained feature vectors are used in the training process. This codebook is re-estimated with HMM parameters for customization. In this process the re-estimation has resulted in zero vectors for the transitional parameters during the transformations of rotation, scaling and shifting which acted as a limitation of this approach. Grobel and Assan (1997) in "Isolated Sign Language Recognition using Hidden Markov Models" also worked out a doubly stochastic process and recognized 262 isolated signs with an accuracy of 94%. With the intention to lay a strong foundation for American Sign Language Recognition (ASLR) (Wang, Leu, and Oz. 2006) have developed a multidimensional HMM using a sensory glove for identifying the hand shape and motion tracker to identify the transition of the hand movement. This model was able to detect all the English alphabets and 36 hand gestures with average accuracy of 95%.

In a similar line, (Wang et al., 2012) presented a dynamic hand gesture recognition system using HMM in "Hidden-Markov-Models-Based Dynamic Hand Gesture Recognition". In this process the hand is detected with Adaboost algorithm and its trajectory points (Yilmaz, Javed, and Shah, 2006; Chen et al., 2003) are tracked based on contours. The global and local features viz. Invariant curve movements and orientations are computed to represent the trajectory of the hand gestures. A hybrid recognition approach is carried out in "American Sign Language Recognition using Hidden Markov Models and Wearable Motion Sensors". Here, ASL to speech translation of words was proposed (Fatmi et al., 2017). This proposal uses both the vision based and sensory based recognition approaches i.e., Myo armbands, camera and 3D depth sensors (Supančič, et al., 2018) for capturing the user's gestures. A blend of Gaussian Mixture Model (GMM) and HMM (Chunli et al., 2001) technique is used to classify the ASL words with an accuracy of 96.15% as mentioned. (Tornay et al., 2020) worked on HMM structure which facilitates to select a model which defines optimal states for every sign using k-means in "An HMM Approach with Inherent Model Selection for Sign Language and Gesture Recognition". The authors experimented with multiple datasets - German, Turkish, Hopsi Chalearn to yield a better performance in comparison to the models that determine the optimal states based on the test set. HMMs have been laid as a baseline owing

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to modeling both isolated and dynamic gesture data. In spite of extensive models designed with HMM, structuring a model with a high number of sign recognitions has been a challenging task.

A group of classification techniques are also experimented in sign language recognition. In this context Support Vector Machines (SVM) and K-Nearest Neighbor (KNN) variants are studied and are detailed here.

Raheja et al. (2016) in "Indian Sign Language Recognition using SVM" tried to classify 4 gestures - A,B,C,Hello based on Hu moment features along with motion trajectories. The results were tested using MS Kinect and classic SVM classifiers and were able to classify 3 gestures -A,B,Hello with 100% and C with 90% accuracy. In another paper titled "Sign Language Recognition with Support Vector Machines and Hidden Conditional Random Fields: Going from Fingerspelling to Natural Articulated Words" (De Souza et al., 2013) presents a two layered SLR. In this model, first the hands and faces are detected using a depth sensor and object tracker. Then hands are classified using SVM (Mani and Bhaskari, 2014) to recognize static gestures in the first layer. These static gesture sequences are joined with spatio-temporal, facial and trajectory information in the next layer to generate feature vectors with probabilities using HMM. Hidden Conditional Random Field (HCRF) learns these feature vectors to recognize static and dynamic gestures and validates them with significant efficiency.

The work proposed by (Revanth and Raja, 2019) in "Comprehensive SVM based Indian Sign Language Recognition" detected hands through edge detection based on Region of Interest (ROI) from which Oriented fast and Rotated Brief (ORB) features are extracted. These features are clustered for training and testing the model using K-Means. SVM, Naive Bayes, KNN, Logistic Regression classifiers are used for comparing gestures recognition results on a dataset of 25 signs. The results were processed on scikit.metrics open source tool and it was observed that SVM classifiers showed higher performance with an accuracy of 90.54% .

In similar lines another KNN based approach, (Sharma et al., 2014) in "Indian Sign Language Recognition using neural networks and KNN classifiers" arrived at 97.10% accuracy in recognizing numerals 0 to 9 with a rigorous trained database of 500 images for each numeral using a neural network and KNN classifier. In order to recognize English alphabets (Utaminingrum et al., 2019) in "Alphabet Sign Language Recognition Using K-Nearest Neighbor Optimization" grouped the alphabets based on the shape of the hand like holding hand, straight finger, leaning finger. KNN was optimized by incorporating SMART techniques for weights calculation of the features based on which the gestures are classified with a minor variation in accuracies under different lighting conditions.

Some of the Indian sign language gestures are represented using both hands of the user. Such a work is carried out in "K-Nearest Correlated Neighbor Classification for Indian Sign Language Gesture Recognition using Feature Fusion" (Gupta et al., 2016) to classify single handed and double handed gestures with a fusion of HOG and SIFT features from the gestured images. Further the gestures are classified using KNN. But only 179 out of 200 double handed gestures were classified accurately which acts as a major limitation. Gesture signs of English alphabets with a dataset of 520 images are recognized in (Benjamin et al., 2017) "Sign Language Recognition System to aid Deaf-Dumb people using Contourlet Transform". This work derives directionality features using Contourlet transform with double filter banks and KNN classifier for gesture recognition and the obtained results is machine dependable.

Coming to modern class of techniques, a work titled "Deep Convolutional Neural Network for Sign Language Recognition", (Rao et al., 2018) created an Indian sign language gesture dataset for mobile application. For this dataset 5000 signs of 200 gestures from a continuous video, each at varying angles are captured by different users in selfie mode aiming to be operated by the hearing impaired through

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mobile application. They proposed a CNN model with four stochastic pooling layers. Training is provided in batches with different orientation and sample sizes and an average recognition accuracy of 92.88% is observed. (Alawwad et al., 2021) introduced a system in "Arabic Sign Language Recognition using Faster R-CNN" to recognize 30 alphabets of Arabic Sign Language. In this system Region-based CNN extracts and maps image features to study the hand position relaxing the segmentation task. VGG-16 model and Res-Net model are implemented on an ArSL dataset which yielded 93% accuracy and is robust to background variations of the images. However, a noticeable reduction in efficiency in terms of time consumption persists.

The work in the paper titled "Real-time American Sign Language Recognition with Convolutional Neural Networks" (Garcia and Viesca, 2016) developed and implemented ASL fingerspelling translators using CNN. A pre-trained Google Net architecture is trained on ILSVRC2012, Surrey and Massey University datasets for transfer learning. This model identifies letters a-k (excluding j) with considerable efficacy and is robust to different lighting conditions. (Bachani et al., 2020) have taken only the shape of the hand as the feature in "Sign Language Recognition using Neural Network". In this work CNN is used to classify the images for recognizing the gestures with an accuracy of 92.48%. The authors of "Sign Language Recognition Using Deep Learning on Custom Processed Static Gesture Images" used the Inception V3 model for static gesture recognition (Das et al., 2018). The Inception model runs the convolutional and pooling layers in parallel instead of sequential, after which the outputs are flattened to act as input to the next block. This model obtained an accuracy of 90% and suits applications running with limited resources. (Sharma et al., 2021) in "Benchmarking deep neural network approaches for Indian Sign Language recognition" reviewed the works of VGG16 models with fine tuning and transfer learning along with hierarchical neural networks. Performance of these models is evaluated on a simulated environment with different lighting and background conditions. The analysis shows that the performance of hierarchical models outperformed the other two models with an accuracy of 98.52% for single hand gesture and 97% for double hand gesture.

A language specific analysis is another important vertical in SLR. In view of this some of the researchers have worked on sign recognition specific to a language and are presented as follows. A dataset of 5100 Chinese sign vocabulary is presented in "A Real-Time Large Vocabulary Recognition System For Chinese Sign Language" (Chunli et al., 2001). The data is collected from cyber gloves that are mounted with 36 sensors and three receivers and a 3D tracker. Each sign is built with HMM having a different number of states. Isolated gesture is set with 3 HMM states whereas the number of HMM states for complex/ continuous gestures is estimated based on a dynamic programming approach. This approach aims to match the bunch of isolated gestures for each continuous gesture. Finally a 48 dimensional vector results for which code words are generated using Gaussian clustering. Fast matching methods which rely on probabilities are used for identifying the test gesture codeword and the recognition accuracy is 95%.

Sign gesture recognition is also carried out in Persian language. (Zadghorban and Nahvi, 2018) uses HMM and KNN-DWT for classifying words from the features extracted from motion and shape of hand of continuous gestures in "An algorithm on sign words extraction and recognition of continuous Persian sign language based on motion and shape features of hands". Out of 46 Persian words, 20 signs were recognized by hand shape and 26 signs by motion emphasis with promising results.

Zhang, Tian, and Huenerfauth (2016) proposed a framework in "Multi-Modality American Sign language recognition". The multi modalities include both hands, facial expressions (Tian, Kanade, and Cohn, 2005), body movements captured by Kinetic depth sensor (Kumar et al., 2017). Each gesture acquired from the given modalities is labeled with a state. This work has considered the hand states for

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which features are generated in the form of a binary vector. DMM-HOG and Bag of Words techniques are used on the input modalities for training and SVM classifier is used for classifying the gestures. But many false positives were produced for frequently used words.

Indian Sign Language (Raheja et al., 2016; Revanth and Raja, 2019; Sharma et al., 2014; Gupta et al., 2016) uses both the hands unlike many other languages. But involving both hands may sometimes lead to occlusion. Though hardware / sensory based techniques can address this issue with the help of hand position and orientation details, the need of initial setup makes them less considerable. In this concern, edge and contour based techniques are commonly used for hand detection before the leap of machine learning algorithms.

EXPLORATION OF RESEARCH GAPS ON SLR TECHNIQUES

This section provides an insight of the existing traditional and modern SLR techniques. The details presented in Table 1 are mainly concentrated on exploring the research findings during the last decade.

CONCLUSION

Over the past decade, large amount of research has been found in the area of object detection. In spite of these research findings, there has been growing concerns towards the application of object detection in various fields of study. This work majorly concentrated on exploring the various object detection methodologies towards sign language recognition in gesture recognition applications. According to the literature, SLR has its expansion in different verticals, where each vertical insists on the type of approaches. In this work, each approach is clearly presented with its own pros and cons. The accuracy and efficiency analysis of the literature has notified that deep convolutional neural networks (DCNN) are performing better than the traditional approaches. Another observation is that when it comes to certain applications a hybrid approach of traditional image processing and DCNN techniques would be optimal. Focusing on providing assistive aids to disabled people, one should come up with a complete product architecture. In this regard an in depth analysis of various designing aspects is in need. Henceforth, the study can be originated with finding optimal development approaches. The future trends can be expected to come up with best solution that addresses the identified challenges in this research study.

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APPENDIX A

Table 1. Study of traditional and modern SLR techniques

Sl. No	Author	Year	Gesture Recognition method	Feature extraction	Input Modality (2d, 3d,RGB, Depth)	Dataset	Language	Results	Observations (limitations / future scope)
1	Tanguay	1995	HMM	Hand positions, scaling and velocity components	2D	5 alphabets	ASL	-	It's not robust to transformations like rotation, scaling and shifting
2	Grobel and Assan	1997	HMM	Hand Shape, Orientation, Location	2D	262 isolated signs	ASL	94% accuracy	Input modality and time variance in covering signs is taken into consideration for model estimation. When the observation sequence is large the HMM parameter estimation is still found to be challenging.
3	Wang, Liu, and Oz	2006	HMM	-	2D	62 signs	ASL	95% accuracy	Clustered Gaussian distribution is used to develop the codebook which aims to categorize known unknown gestures.
4	Wang et al.	2012	HMM	Adaboost algorithm with HOG - hand location sequence	2D	-	-	-	The developed tracking algorithm is sensitive to light and gesture detection is successful only when it passes through all the states and reaches till end. More focus on improving the tracking is required.
5	Fatmi et al.	2017	HMM	Orientation and angular velocity of the hand movements	3D	-	ASL	96.15	The recognition of dynamic gesture has been a challenge for which incorporation of weighting factor is proposed and further study on the same is required.
6	Tornay et al.	2020	HMM	Hand Shape, motion, position, facial expression, body posture	Isolated	Hopsi, DGS dataset, Chalearn14	German, Turkish, Hopsi Chalearn	-	Determining the optimal number of states in the HMM model is targeted to yield better performance. More structured model to reach huge sign recognition has been a challenge.
7	Raheja et al.	2016	SVM	Humoment Features	-	-	ISL	97.5%	The model is experimented on a limited number of gestures which can further extend over a large data set.

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Table 1. continued

Sl. No	Author	Year	Gesture Recognition method	Feature extraction	Input Modality (2d, 3d,RGB, Depth)	Dataset	Language	Results	Observations (limitations / future scope)
8	De Souza et al.	2013	SVM and HMM	Spatio-temporal and facial information	Static and dynamic	59 words	Brazilian Sign Language	-	Discriminative models are found to generate better system performance avoiding over fit.
9	Revanth and Raja	2019	SVM	-	-	25 signs	-	90.54%	-
10	Sharma et al	2014	Neural Networks and KNN	-	isolated	Numerals 500 images per each	ISL	97.10%	-
11	Utaminingrum et al	2019	KNN and SMART		Hand shape based	alphabets	-	-	Under different lighting conditions
12	Gupta et al.	2016	KNN	Fusion of HOG and SIFT	Static gestures	-	ISL	-	179 out of 200 double handed gestures were classified accurately
13	Benjamin et al.	2017	KNN	Contourlet Transform	Static gestures	520 images (20 of each alphabet)	-	-	-
14	Chunli et al.	2001	HMM	-	Isolated	5100 signs	CSL	95%	-
15	Zadghorban and Nahvi	2016	HMM, KNN-DTW	Zernike, Hu moments, fourier descriptors	-		Persian Sign Language	-	-
16	Rao et al.	2018	CNN	-	-	5000 signs of 200 gestures	ISL	92.88%	Mobile selfie sign language
17	Rahaf et al	2021	VGG16, ResNet	-	-	30	ArSL	93%	-
18	Bachani et al.	2020	CNN	Hand contour and complex moments	Simple gestures	-	-	92%	Stable to different lighting and other environment conditions
19	Das et al	2018	CNN using Inception v3	-	Static gestures	-	ASL	90%	Reviewed Sign language detection techniques which incorporate depth data and Machine learning algorithms
20	Ashish et al	2021	VGG16, Hierarchical neural networks	-	Single and double hand gestures	1,49,598 augmented and pre-processed images	ISL	98.52% for single hand and 97% for double hand	Hierarchical model addresses the issue of occlusion during both, single and double hand gesture recognition under various simulated environments.
21	Rahman et al.	2019	CNN	-	-	65,000 images from 4 different datasets	ASL	99.90%	Model uses CNN with 6 convolutional and 3 pooling layers with ReLU activation function

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Chapter 28
Citizen Participation in Law-Making in the European Union

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ABSTRACT

A regulatory policy based on the idea of smart regulation takes the view that legislation and regulations serve the economy, and therefore, laws must be intended to create the conditions to improve national economies and economic growth, as laid down by the OECD and the European Union itself. Such a regulatory policy is informed by a set of principles which apply to both regulatory institutions and regulations, such as transparency, cooperation, accountability, efficiency, effectiveness, participation, and openness. This regulatory approach takes the view that regulations are of better quality when they have been influenced by citizens. As a consequence, smart regulation results in participatory democracy. Citizens collaborate with the government in the lawmaking process at an early stage and throughout the lifecycle of a legislative act by means of consultations. This chapter focuses on consultation as the principal mechanism for participatory democracy in the context of smart regulation law-making in the European Union.

INTRODUCTION

The increase in the democratic participation of citizens has been a constant throughout the evolution of the European Union which has run in parallel with its progressive increase in competences as the states have ceded sovereignty to it in areas increasingly distant from those that justified the creation of the European Communities in the middle of the last century. The gradual expansion of the Community cosmos has made more evident the distance between the citizens, around whom the European Union orbits, and the institutions with the capacity to decide, which has accentuated the perception of the deficit of democratic legitimacy that has been attributed since its inception to this supranational organization.

To remedy this, the European Union has resorted to democratic participation, first through the mechanisms of representative democracy and the direct election of members of Parliament by the citizens and then by articulating integrated collaboration mechanisms in the field of so-called participatory

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democracy (Garcia, 2015). The legitimacy provided by the mechanisms of representative democracy is limited, and for this reason it is necessary to complement this system with other options that involve the use of participatory democracy. Such participation confers a greater degree of democratic legitimacy to the rules on which these mechanisms are projected, since, being exposed to the participation of citizens, who theoretically have been able to contribute to the contents of the rule, it is assumed that they have the support of the recipients (Prieditis and Karpen, 2002). On the other hand, the principles postulated in the White Paper on European Governance have also influenced the projection of the premises of participatory democracy on the normative procedure.

From a more general point of view, it is also necessary to refer to a trend that is gradually consolidating and that tends towards a growing recognition of the capacity of individuals and non-governmental organizations to act on their own at the international level. This implies a growing tendency for citizens to participate in the creation of international law, or in our case of European law, although this is far from recognizing the capacity to create this right themselves.

All these perspectives converge in the need to articulate mechanisms that allow citizens to participate in the creation of the European legal order, whether or not the resulting rules affect their rights and interests.

Well, the appeal to civic participation for legitimate democratically European standards has to be placed in the context of a regulatory policy that seeks to streamline the legal system by establishing procedures to conclude the character inexcusable of the standard, the needs and objectives that you are going to attend and that articulates at the same time formal channels to integrate the public interest and individual interests converging, usually financial, in its precepts. The result is the so-called "smart legislation", a term that has been adapted to Spanish legislation and that comes from the literal translation of the expression "Smart regulation" (Baldwin, 2005), which arose in the scope of certain international organizations with economic projection, such as the OECD and the European Union. From the point of view of this regulatory trend, the exercise of regulatory power is a kind of last resort, so that before approving a new rule the need for it must be verified. The aim is to produce "quality legislation", i.e. efficient, effective and proportionate legislation that is not unduly burdensome for its recipients, especially those with economic interests. The idea is that the legislation adopted should be able to promote growth and promote development without interfering with economic agents.

The so-called" smart legislation", a term that we will adopt hereafter to simplify the references to this regulatory trend, makes use of the mechanisms of participatory democracy and reshapes and adapts them to their needs and objectives, integrating them into the regulatory procedures. The institutional proposals on the improvement of legislation call for streamlining the drafting of legislative acts, considering that it is not a matter of legislating more, but better. Precisely, the participation of citizens in the processes of production of law is one of the elements that characterize the call legislation intelligent, composed by rules whose approval has been planned in advance, that are intended to be effective and efficient by focusing on issues that really need a eu regulation, that they try to anticipate the effects of such regulation on the sector that is projected, and which are subject to a continuous process of evaluation to detect those contents that can be improved or that are even unnecessary.

Logically, in order to achieve some ambitious goals, it is necessary that the institutions involved in the process of production rules take into account and assess different sources of information, which should not overlook the importance of the contributions of the general public and those affected by the legislation. It can therefore be said that the use of the mechanisms of participatory democracy is one of the presuppositions of intelligent legislation and one of the elements that define such legislation.

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Consequently, the general interest appreciated by the public authorities no longer legitimizes the rules in itself. Norms must also be legitimized through the contributions of the subjects affected by them. The public authorities have lost the monopoly to determine the legal interests served by the rules, which have to be defined with the participation of external actors through the channels offered by the mechanisms of participatory democracy.

"Smart legislation", which seeks to rationalize the legal system and norms through normative processes that make use of the mechanisms of participatory democracy, is reshaping the legal system, not only at the European level, but also, by extension, at the internal level of the member states, including Spain.

This legislative formulation gradually leads to a normative context in which interventionist and restrictive measures are increasingly exceptional (Lopez, 2010). This implies the adoption of rules whose contents are increasingly less prescriptive, where they are regulated by principles and where recourse to coercive measures is increasingly limited. Alternatives to classic regulation are sought and rules are disregarded when possible in favor of other regulatory models involving self-regulation and so-called "soft legislation". Where the rule is required, it seeks to limit its interventionist and coercive impact, as we have said.

This trend is very clear when it comes to the regulation of activities and sectors that have an economic background. However, paradoxically, when it comes to the regulation of matters relating to public order, this lax regulation often contrasts with rules that restrict the rights of individual or collective exercise and grant the public authorities important powers of sanction.

Among the mechanisms of participatory democracy in the service of intelligent legislation, the European documents basically refer to consultations, integrated into impact assessments, prior to the adoption of rules or after such approval, that is, once the rules have entered into force and have been in force for a certain period of time. To these must be added the European citizens ' initiative, whose well-understood virtuality can be linked to the consultations carried out in the early stages of the regulatory process, when the Commission is considering the preparation of a regulatory proposal.

The objectives and purposes of the "smart regulation" reshape these participatory tools, so that the query is integrated into the impact assessment procedures, and performed in a very early stage of the standard-setting process, when the standard is still in gestation, in phase pre-legislative, with the aim that the subjects really have the possibility to influence the content of the standard and to integrate their interests. In addition, however, consultations are envisaged not only at the time of adoption of standards, but once they have been adopted and are in force. The consultation of citizens extends to the evaluation of the rules in force to assess the desirability of their maintenance or the need for their repeal or modification if it is found that they have become ineffective or obsolete. The consultation procedures are structured so that the so-called interest groups or pressure groups gain weight, to have the possibility of influencing the norm, to the detriment of the citizens individually considered, becoming a sort of regulators in the shade, as the records of transparency are optional and not mandatory. All these circumstances pervert the very concept of participatory democracy, conceived and designed to enhance the direct collaboration of individuals and the associations that represent them with the public authorities.

Ultimately, the legal justification for the application of participatory democracy mechanisms in standard-setting procedures has several reasons and is the product of a synergy of factors that are both cause and effect of the normative outcome. In this paper, the aforementioned mechanisms are analyzed and their practical effectiveness is evaluated, highlighting the problems and shortcomings that prevent and hinder their complete effectiveness or distract them from the main objective for which they were conceived.

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BACKGROUND

Smart regulation stems from an economic background. The term originated in the context of the EU and also in the context of international organizations, such as the OECD.

A regulatory policy based on the idea of smart regulation takes the view that legislation and regulations serve the economy and, therefore, laws must be intended to create the conditions to improve national economies and economic growth (Xanthaki, 2013). Legislation must contribute to business competitiveness and economic growth by means of the development of quality regulation. The goal is to adopt sound legislation that serves economic purposes. From such a perspective, smart regulation is intended to create the conditions for fostering competitiveness, on the assumption that markets and economic growth deliver sustainable prosperity for all.

The goal is to adopt and maintain high quality legislation, which is the best legislation for economic purposes and also to create a regulatory environment which is favourable to a thriving economy. By high quality legislation, we mean well-informed, efficient and effective legislation which is fit for an economic purpose. Therefore, the quality of legislation is evaluated in economic terms, that is, how well a piece of legislation is capable of meeting economic requirements.

The aim of a regulatory policy based on these assumptions is to adopt well-informed, effective legislation when necessary and only if necessary.

Such a regulatory policy is informed by a set of principles which apply to both regulatory institutions and regulations, such as transparency, cooperation, accountability, efficiency, effectiveness, participation and openness. As a consequence, smart regulation results in participatory democracy (Prieditis and Karpen, 2002) This regulatory approach takes the view that regulations are of better quality when they have been influenced by citizens (Mendes, 2011). Therefore, to produce well- informed and efficient legislation, smart regulation makes use of mechanisms of participatory democracy, under the assumption that the inputs provided by citizens and interested parties contribute to the adoption of better regulations in economic terms.

The aforementioned ideas have had an important impact on the legal systems of some European countries, which make provision for the principles and mechanisms that underpin this concept. Recently, Spain has amended its legislation to introduce these ideas, as in the case of Common Procedural Act.

Smart regulation serves economic purposes because it sets out to create the conditions that make it easier for companies and businesses to thrive in a favourable regulatory environment. In other words, smart regulation sets out to create a regulatory environment, in which companies can succeed.

Along with economic objectives, smart regulation also applies the principles of open governance by resorting to citizen participation and participatory democracy. In doing so, public powers aim to gather data, evidence and information with a view of adopting well-informed and evidence-based decisions, which are intended to be more effective. However, citizen participation is not a goal in itself, rather it is a tool and a consequence of the implementation of smart regulation principles.

These objectives are set out in the inter-institutional agreement between the European Parliament, the Council of the EU and the European Commission on better regulation law-making . As a result, the objectives of smart regulation are as follows:

- Produce effective and efficient legislation for economic purposes

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- Reduce administrative burdens for citizens and especially for companies. If the legislative framework is too complicated, too burdensome or too bureaucratic, the risk is that smaller business are simply not to able to follow it.
- Simplify and make legislation clearer and easier for citizens. The EU legislation should be comprehensible and clear for citizens, allowing them to understand their rights and obligations.
- Avoid overregulation.
- Adopt legislation that allows for economic growth.
- Ensure that decision-making and law-making are open and transparent.
- Ensure that citizens and stakeholders can contribute throughout the law-making process.
- Ensure that regulations are consistent with other regulations and policies.

To this end, EU directives must be transposed in a clear, correct and timely manner and EU regulations must be properly implemented and enforced in all Member states. This brings about legal certainty allowing citizens and companies to benefit from the opportunities of the single market.

Smart legislation must fulfil three requirements:

1. The objectives of smart regulation must be considered throughout the entire lifecycle of the law.
2. It is not only about new legislation but also about existing legislation. This implies that smart regulation refers to the legislative process, but also to the assessment and evaluation of the existing body of law, to make sure that this has not become outdated, obsolete or too burdensome.
3. Implies citizen participation. Smart regulation fosters the contribution of citizens and interested parties throughout the law-making process and afterwards, once the legislation has come into force.

This implies that the quality of legislation must be managed throughout the whole process, namely, the adoption, implementation, enforcement, evaluation and revision of a piece of legislation. To this end, smart regulation makes use of ex ante and ex post evaluations in order to assess new and existing legislation against the principles of efficiency and effectiveness.

There are two mechanisms intended to check and control whether a piece of legislation is fit for purpose and remains as such after being adopted:

- Impact assessments, when developing a piece of legislation. These analyse the potential economic, social or environmental impacts of a proposal and quantify benefits and costs where possible.
- Ex post evaluation of existing legislation. Assessment and evaluation are intended to continue for the lifetime of a law in order to make sure that the legislation remains fit for purpose and delivers the results intended by lawmakers. Regulations must be periodically reviewed. By means of ex post evaluations, public powers must make sure that a piece of legislation has not become obsolete, outdated or burdensome while in force. Through ex post evaluations, the efficiency and effectiveness of a piece of legislation can be evaluated in order to amend, review, codify or repeal a piece of legislation. This also allows public powers to recast legislation. All this contributes to legal certainty, which is essential for economic reasons.

This implies that the regulatory policy is concerned not only with the quality of new regulation, but also with the improvement of existing legislation. For Smart regulation, it is of great importance to evaluate the functioning, effectiveness and efficiency of existing legislation. In this regard, the Com-

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mission must codify, recast and consolidate legal texts. It will also continue to reduce the volume of legislation by repealing obsolete provisions. Recasting legislation ensures that laws remain clear and well-structured after having been amended. Also, over time, legislation may become out of date, and political, social or economic changes may mean that a law is no longer useful, relevant or fit for purpose. Repealing outdated legislation that no longer serves its purpose, or is excessively burdensome, ensures the effectiveness of the EU body of law.

Finally, smart legislation also implies that citizens´ participation is embedded in the law-making process and post evaluations of the existing body of law. Public powers are more likely to deliver high quality legislation if those affected by the Law can put their views during the law-making process and in the assessment of existing legislation (Lopez, 2010). A regulatory policy based on smart regulation principles takes the view that those affected by legislation best understand the impact of a specific Law and can provide public powers with evidence and information, which is necessary to improve legislation. Every stage of the process is open to participation, from the moment a public body outlines a proposal, through the adoption of legislation, to its subsequent evaluation. This would mean citizens' participation all through the life of the law, from the moment when public powers set out to outline a piece of legislation up to the moment when said piece of legislation is repealed. It would mean public consultation on the impact assessment and also on the ex post evaluation once a Law has come into force.

All of this helps to put into practice the provisions of the Lisbon Treaty on participatory democracy. Although smart regulation does not directly aim to allow the public to participate in law-making and decision-making processes, it can be said that participatory democracy in law-making stems from smart regulation. In other words, this kind of regulation triggers participatory democracy so that it is also about citizen engagement and citizen involvement in law-making.

As we said before, smart regulation makes use of mechanisms for participatory democracy in order to adopt and develop well-informed legislation that meets economic requirements.

Two mechanisms must be considered:

- Consultations, which will be analysed in a separate section below.
- The citizens' initiative right is set out in in Article 11 of the Treaty on European Union and Regulation (EU) 788/2019 of the European Parliament and of the Council of 17 April on the citizens' initiative.

This is a mechanism of participatory democracy, which allows citizens to address the Commission in order to suggest the adoption of specific legislation which is within the scope of its jurisdiction with a view to influencing EU policy making and law-making. A citizens' initiative is possible in any field where the Commission has the power to propose legislation, such as environment, agriculture, transport and public health.

The right to initiative and the right to participate in public consultations do not result in the right of citizens to enact or repeal legislation by themselves (Karatzia, 2017). As a consequence, initiative and public consultation are not institutions of direct democracy, but institutions of participatory democracy, as citizens are not empowered to decide for themselves whether a piece of legislation must be passed or repealed. These mechanisms do not imply decision-making by the public. These two aforementioned institutions are intended to allow citizens to collaborate in the decision-making process, by putting their views in public matters. However, by no means are citizens allowed to exercise public power by themselves.

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DISCUSSION: PARTICIPATORY DEMOCRACY IN LAW-MAKING.

Through public consultation, citizens can express their views and priorities on a public matter, thus providing public powers with valuable information for new initiatives or for the evaluation of existing policies and laws. Consultation is essential for well-informed decision-making and for improving the quality of law-making. European Union institutions use the consultation process to collect data and evidence for impact assessments and evaluations, thus enhancing the principle of transparency.

Throughout the law-making process, the Parliament, the Council and the Commission commit to conducting consultations intended for stakeholders and for the public. Based on the openness of the consultation process, there are two different kinds of consultation:

- Public consultations. These are open consultations, in which all interested parties are invited to submit their comments on a legislative proposal.
- Restrictive consultations. This kind of consultation is addressed only to stakeholders and affected parties. This is the case with formal consultation conducted by means of structured bodies. In these cases, contributors have to be selected under specific criteria, e.g. representativeness. In this regard, there is a lack of specific criteria for deciding which particular interest groups should be consulted. The general rule is that the Commission should consult as widely as possible.

As we said before, the objectives of smart regulation must remain constant throughout the life of a law. Therefore, consultation processes must be carried out at the different stages of the law cycle.

Thus, consultations are conducted in the pre-legislative stage by the Commission, before the adoption of a legislative proposal. At this stage, the Commission uses the consultation process to collect data and evidence, as consultation in the preparation of legislative acts plays an important role in the quality of law-making. This implies consultation on:

- inception impact assessments, where the Commission outlines new ideas for policies and legislation or evaluations of existing policies
- aspects of impact assessments, where the Commission analyses the possible economic, social and environmental impacts of a proposal. Impact assessments analyse the problem which is expected to be tackled by European legislation, whether or not European legislation is needed, and map out alternative solutions and asses the economic, environmental and social impacts. Also, impact assessments should quantify benefits and costs where possible. Consultations provide the Commission with better data and information for decision-making.

However, consultations are also conducted in relation to existing legislation. In this regard, consultations are part of ex post evaluations, by means of which the Commission considers whether a piece of legislation is still fit for purpose. Legislation already in force must be evaluated periodically against the principles of efficiency, effectiveness, relevance and coherence, to see whether the EU body of law stays fit for purpose. The Commission aims to amend, codify, recast and consolidate legal texts in order to simplify and make legislation clearer and more up to date. In addition, the repealing of obsolete provisions contributes to achieving the goals of smart regulation by reducing the volume of legislation. Public consultation and stakeholder consultation are likely to provide accurate information about how a piece of existing legislation is being implemented or applied (Garcia, 2015). Repeals, recasts, simplifi-

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cations and withdrawals all benefit from consultation. In this regard, recasting is an effective legislative technique for the modification of existing legislation. Official codification of legislative acts is also an effective legislative technique following the adoption of amending legislation in those cases in which recasting is not appropriate.

Consultations are not only carried out by the European Commission. The European Parliament and Council have also a shared responsibility in the adoption of smart regulation. By means of the Inter-institutional agreement between the European Parliament, the Council of the EU and the European Commission on better regulation law-making, all three institutions agree to collaborate in the improvement of European Union legislation. This means that the two legislative institutions, Parliament and Council of the EU, commit themselves to conducting consultation processes as part of new impact assessments where a legislative proposal has undergone substantial changes as a consequence of the legislative process. We will see later that these requirements are not always fulfilled by the aforementioned institutions.

To be effective, consultation must start as early as possible. Interested parties and the general public should be involved in the development and design of a legislative act at the very beginning, that is, at a stage when their contributions can still have an impact on the formulation of specific policy or law.

Stakeholders and the general public will be able to express their views throughout the life of a piece of legislation. As a consequence, roadmaps and inception impact assessments will give stakeholders the chance to provide feedback and information from the very start on a new initiative. There will also be twelve-week public consultations when preparing new proposals and when evaluating the effectiveness of existing legislation. After the adoption of a proposal, stakeholders and citizens will be invited to submit their comments within eight weeks. The Commission will collect these views and will present them to the European Parliament and the Council.

Afterwards, when a piece of legislation has come into force, the consultation process will continue by means of periodic ex post evaluations. Consultation will also be part of these assessments of existing legislation.

From the point of view of democratic participation, consultation is addressed to different parties. Depending on the issue, consultation provides opportunities for input from civil society organizations, individual citizens, academics, technical experts and interested parties in third countries.

Civil society organizations are the main structures of society apart from government and public administration, which is why it is so important to involve these organizations in the consultation process. The specific role of such organizations is closely related to the fundamental right of association, which brings people with similar interests together. Civil society organizations are consulted in a formal way, which means that there are structured mechanisms for consultation. The problem lies in deciding which organizations to consult. This requires specific eligibility criteria to select the target group before the launch of a consultation process. In this regard, it is necessary to make reference to the inter-institutional agreement between the European Parliament and the European Commission on the transparency register for organizations and self-employed individuals engaged in EU policy-making and policy implementation, April 16th 2014. The transparency register provides EU institutions with information about any citizens or private entities, or formal or informal groups, associations or networks engaging in activities intended to influence European policies and decision-making (Baldwin, 2005).

Consultation is also possible through institutionalized advisory bodies, such as the Economic and Social committee. These advisory bodies do not exclude direct contact between the Commission and interest groups. They play an important role in the consultation process. Where a formal or structured consultation body exist exits, the Commission must take steps to ensure that its composition reflects the

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specific area of interest. If this is not the case, the Commission should extend the consultation to make sure that all interests are taken into account.

Regardless of the way in which consultation is conducted, these processes must be carried out by involving all significant parties affected by the legislation and also potential interested parties at the earliest possible stage while developing new legislation. Therefore, consultation is addressed to those directly affected by a piece of legislation, be they citizens or stakeholders. The aim is to ensure that all relevant parties are properly consulted, both when designing new legislation and once legislation has been implemented.

However, this is not incompatible with open consultations, which are conducted simultaneously, so that no interested or affected party is excluded. The Commission is committed to an inclusive approach, which means consulting as widely as possible. Thus, consultation processes must involve both those affected directly by a piece of legislation and the general public. This is closely related to the principle of open governance. In practice, it means that every individual citizen or association will be able to provide the Commission with individual contributions. Both are allowed to submit comments on legislative proposals, albeit at different stages of the process.

Although the consultation is addressed to different parties and interest groups, stakeholders are likely to have a greater impact on the law-making process and ex post evaluation, leaving individual citizens in a weaker position. Stakeholders and interest groups have their own consultation mechanisms and are in better position to influence the law-making process and the subsequent evaluation of existing legislation, meaning that Laws are likely to be influenced by economic interests.

Legislative acts, including statutory and secondary legislation, are subject to consultation processes. Also, non-legislative acts are subject to consultation, due to their importance in the implementation and enforcement of legislative acts. This includes delegated acts and implementing acts. In this regard, it is important to make reference to the Interinstitutional agreement between the European Parliament, the Council of the European Union and the European Commission of 13 April 2016 on Better Law-Making, the annex of which sets out a Common Understanding between the European Parliament, the Council and the Commission on delegated acts.

CONCLUSION

The process of European creation and integration has from the beginning raised doubts of democratic legitimacy arising from the very circumstances of its creation, because the European Union owes its beginnings to constituted powers, which are the governments of the Member States. Indeed, the process of European development and integration has been made possible by the agreement of the central governments of the states, agreements that have been ratified in each country according to its own internal constitutional system. Therefore, in the process of European integration there has not been a genuine constituent power, understood as a prior power or original power and source of legitimacy of the European Union and its institutions. The absence of a sovereign European people is absent in the process of European construction. Instead, it is the Member States that constitute the mandatory reference point in the European integration process. We can therefore say that the European Union originally lacked direct democratic legitimacy, since its existence derives from a constituted power and therefore its democratic foundation rests on the legitimacy provided by the governments of the Member States. This indirect legitimation has been perceived as lacking as the European Union has assumed greater powers.

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The situation has sought to be corrected in parallel with progress in the process of European integration. Thus, as states have ceded sovereignty and the exercise of powers, the need to give greater legitimacy to the institutions that make European decisions and policies has also become more evident. These institutions need to connect with citizens to get the support their decisions need.

It is necessary to point out that this democratic legitimacy implies a connection between rulers and governed, and it manifests itself basically in two ways: the first, through legal mechanisms that allow citizens to choose their representatives and control their political and government action. And a second one that focuses on the effectiveness of the results obtained, when assessing to what extent the results produced by a given political structure reflect the demands of citizens and meet their needs. This second legitimizing mechanism of public power focuses on the decision-making process, and in this sense praises the adoption of legal acts that take into account the opinion, will and opinion of citizens, in a way that enhances democratic participation in this process.

The mechanisms of participatory democracy have been progressively incorporated into the European Union, although the use of representative democracy was the first attempt to address the deficit of democratic legitimacy that has been attributed to the European Union since its inception, and for this, the attention was focused on the European Parliament. Thus, the strengthening of democratic legitimacy has long been associated exclusively with this legislative institution. European leaders understood that the direct election of MEPs would give the EU the direct legitimacy it had previously lacked. Therefore, the elections to Parliament were the first attempt to directly involve the citizens in the European process and justified the progressive increase in the powers of this institution.

However, this strengthening of the role of Parliament has not been sufficient to strengthen the democratic legitimacy of the European Union, as we will see in the next sections. That is why other mechanisms have been established to encourage citizen's participation in the legislative and decision-making process, such as those deriving from the exercise of participatory democracy.

Consultations are an essential part of the law-making process. They contribute to the making of well-informed and evidence-based legislation and to the improvement of the quality of law-making. By means of public consultations, external contributors can express views and provide legislative powers with valuable information for new initiatives and for the evaluation of existing legislation.

However, consultations face certain limits. Their scope is restricted, as they play an important role in the pre-legislative stage, when the European Commission is outlining and developing new legislative proposals. However, such proposals are likely to change through the legislative process. The two legislative institutions (European Parliament and European Council) are likely to introduce amendments on these proposals. However, consultations on impact assessments during the legislative process are a rare practice. Producing smart regulations should mean that all three European institutions cooperate in order to ensure the best EU legislation. For this reason, according to the inter-institutional agreement, these institutions agree to cooperate and collaborate in the delivery of smart regulation. By means of this agreement, the Council and the European Parliament commit to carrying out impact assessments during the legislative process whenever they make an agreement that changes the initial Commission proposal. In such cases, they commit to re-assessing the social, economic and environmental impacts of the draft legislative act, before any final decision is taken, which will mean conducting a new consultation process as part of the impact assessment. However, this does not happen in practice.

Another problem is the lack of binding rules governing consultation, as there is not a legally binding instrument that regulates this. Instead, there is a set of minimum standards and general principles that lay down a framework for consultation, but not a legal framework. The Commission is not legally bound by

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any legal consultation procedure. Communications from the Commission are not legal legislative acts, but political acts, which propose a set of recommendations on consultations. The Commission has laid down a number of general principles that should govern its relations with interested parties, and a set of minimum standards for the Commission's consultation processes, although they are not binding in any way. These general principles and minimum standards take the form of a Commission communication (which is a policy document) rather than adopting a legally-binding instrument. The Commission has always been against legally-binding acts in this regard, lest a legislative act be challenged in Court on the grounds of lack of consultation of interested parties. The result is a set of guidelines that govern the Commission's administrative practice. Neither the general principles, nor the minimum standards are legally binding. Apart from this, it is also necessary to point out that consultations are not sufficient in and of themselves. It is also important to guarantee certain aspects of the consultation process in order to ensure that European institutions make the most of the inputs provided by the public and by stakeholders. Procedural rules should state how contributions should be analysed in order to determine to what extent these views can be accommodated in the legislative proposal. Acknowledgement and feedback should include how the consultation process is conducted and how the results will be taken into account in the legislative proposal.

Finally, several questions arise from this approach to European Union legislation: if public powers take the view that the law-making process and the existing body of legislation must be fit/suitable for economic purposes, should we assume that economic interests and the common good coincide? Is economic growth a matter of public interest? To what extent are economic interests compatible with public interest? Is there a conflict of interests? Do economic interests conflict with public interest? Do they exclude each other? All these are unsolved questions, which will have to be answered in the long-term, after evaluating the real impact of this approach on the law-making process and on the public interest.

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