Handbook of Research on

Management and Strategies for Digital Enterprise Transformation

Kamaljeet Sandhu

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Handbook of Research on Management and Strategies for Digital Enterprise Transformation

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I dedicate this book to the memory of my mother and father.

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artificial intelligence will bring to the table is that educators and students will likely not be trapped with repetitive tasks and can focus on being creative, learning, and teaching. The three elements they explore in this chapter will give insight into work previously completed, research being conducted, and future insights and observations.

Robots and artificial intelligence have been touted as vehicles for generating operational efficiency and cost savings for a business enterprise. Specifically, automated, digitalized frontline services have the potential to streamline an enterprise's service efficiency, alleviate burdens from its human employees, and enhances its relationships with the customers. Besides these cost and functional benefits, this chapter posits that robotic services can garner customers' preferences and satisfaction, that is, there are situations in which robotic services are not only a cost-saving option, but they are even preferred by an enterprise's customers. Specifically, two important drivers—social distancing and utilitarian expectations of services—can lead to customers' choosing robots over humans. This chapter concludes that deploying and managing digital and automation technologies, such as service robots, in frontline services can not only transform an enterprise's operations but also enhance its customer management and service expectations.

Education enterprises (e.g., schools, universities, online platforms) seeking digital transformation require careful evaluation of their strategies and transformative capabilities. Although transformation of teaching routines is slowly evolving into student-centric learning, individual-oriented learning routines (assess, evidence, credentials) are complex to manage compared to established teaching routines (define, engage, and enhance) using existing digital learning management systems. This has resulted in poor tracking of 21st century skills (21C) of learners, which are highly sought by teachers, learners, and employers. Based on reviews of blockchain use cases from the education literature, this study proposes a blockchain for education learning ledger (BELL) model to capture and track 21C skills demanded by Industry 4.0. The BELL model includes an innovative assess skills chain for developing strategic learning capabilities and enabling reconfiguration of learning outcomes.

In this chapter, the EIL (Effective Innovation Leadership) framework is tested empirically. First, peer-reviewed journals in the innovation management, leadership, and transformation discipline are analyzed.

Second, a pre-test with 58 executives takes place. The response behavior of the participants varies depending on the company's degree of digital maturity. Third, 20 innovation leaders employed in mature digital companies answer the survey. The participants perceive their company as innovative and state that up to 89% of created innovations are digital. Values relevant to digital innovation leaders are innovation, responsibility, positivity, and transparency. Relevant strengths are creativity and learning. Both strongly correlate with a few efficacy items. Decisiveness correlates with innovation strategy. Entrepreneurship, self-regulation, and culture correlate with each other. Creativity connects the value of innovation and the practice of communication. The insights from this chapter contribute to building a reliable and valid factor-based effective digital innovation leadership questionnaire in the future.

Chapter 6

The author in this study presents the new term called "Quadruple Change" as a framework for delivering high-value digital transformation in organizations. The quadruple change consists of technical, organizational, social, and global change during digital transformation. The author conducted a qualitative exploratory study to explore strategies that leaders need to adopt to cultivate transformation agents during digital transformation toward establishing sustainability. The study revealed that for successful digital transformation, organizations need to empower employees, engage them in the process of change, and develop the culture of transformation in the dynamic environment. Toward this achievement, cultivating transformation agents based on quadruple change is one of the significant steps. The study findings identified seven factors contributing to cultivating transformation agents in organizations, including vision creation, mindset change, knowledge improvement, innovation development, motivation increment, leadership support, and collaboration.

Chapter 7

India has high digital ambitions despite considerable poverty, the digital divide, and continued high currency usage. Digitalisation has caused both excitement and fear in India – government and companies are excited about an increase in efficiency, closing the leakages, customer confidence, and satisfaction. The present study examines the role of digitalisation in the Indian economy, especially in creating a unique Digital ID (Aadhaar) and its impact on the economic, financial, and payment infrastructure. The study finds major innovations in cheque processing, real-time gross settlement, national electronic fund transfer, and other payment methods have considerably reduced the cost of banking facility in India. The Indian capital market has already witnessed electronic trading and settlement and has recently witnessed emergence of no-brokerage companies which can change the fundamental dynamics of the investment industry in India. The retail trade market, especially e-commerce, ride share market in India reflecting global trends, has also witnessed considerable "multi-homing."

Faced with the increasing number of challenges that came with globalization, the developed countries have become aware of the insufficiency of traditional production systems and increased investments in technological developments in the production sector. With successive technological developments, the competition in the production sector has increased, and businesses have had to undergo major changes. It was aimed with these changes to respond quickly to dynamic market conditions and customer demands. The project, which was firstly introduced by Germany as Industry 4.0, affects enterprises both technically and socially. Employees have to adapt to digitalized production systems and keep up with technological developments. In a world where inter-business and inter-disciplinary studies and collaborations increase and operations are carried out on a project basis, project managers are obliged to adapt quickly to the continuing digital transformation. In this context, the chapter aimed to identify the impact of digital transformation on project managers' competencies.

This chapter aims to study the digital transformation strategies of public management and, within this, the analysis of the main aspects of the transformation of the public acquisition system. It is based on the new public management approach, its evolution towards post-new public management, as well as other strategic derived approaches, such as all government, good government, united government, or government of the digital age. The application of lean and agile methodologies is a great facilitator to support the digital transformation processes of public administration, and far from being incompatible, they are complementary and combinable. This work focuses on the design of strategies for the restructuring of public investment and procurement systems, a critical part of public management, making them more effective and efficient, seeking a greater rationalization of public spending, as well as avoiding waste and corruption.

Nowadays, the main features of Industry 4.0 are interpreted to the ability of machines to communicate with each other and with a system, increasing the production efficiency and development of the decision-making mechanisms of robots. In these cases, new analytical algorithms of Industry 4.0 are needed. By using deep learning technologies, various industrial challenging problems in Industry 4.0 can be solved. Deep learning provides algorithms that can give better results on datasets owing to hidden layers. In this chapter, deep learning methods used in Industry 4.0 are examined and explained. In addition, data sets, metrics, methods, and tools used in the previous studies are explained. This study can lead to artificial

intelligence studies with high potential to accelerate the implementation of Industry 4.0. Therefore, the authors believe that it will be very useful for researchers and practitioners who want to do research on this topic.

e-Government (e-Gov) involves the use of information and communication technologies (ICTs) to achieve political goals. Innovative ICTs should be integrated in e-Gov and e-business services to maximize their potentialities/efficiency and to reduce costs. Currently, diverse conceptual models of e-Gov are purposed. These models are applied to understand and optimize governance processes. Globally, it is possible to identify a gap between e-Govs and digital enterprise transformation of developed and developing countries. Digital divisions are closely related to a gap between citizens, families, and businesses regarding the access to ICT and internet in different regions. Are the international recommendations on e-government, digital division and management, and strategies for digital enterprise transformation producing successful outputs? This study aims (1) to describe and analyze international recommendations on e-government, digital division and management, and strategies for digital enterprise transformation and (2) to present practical cases.

Preface

In recent times many organisations of all sizes (e.g. small, medium, and large) are moving towards digital enterprise. The business landscape has changed in the year 2020 and into the future, with the far-reaching global impact of COVID-19 pandemic, the demand and the necessity for digital enterprise transformation have accelerated exponentially. Management and strategies for the adoption and wider usage of newer digital technologies for the transformation of an enterprise through digital tools such as real-time video communications (e.g., zoom, skype, google meet, and many others) through which physical distance has disappeared, which has shown enterprise and people no longer required to be physically present in the same place having face to face interaction rather can be spread far away geographically. Large scale applications of artificial intelligence is being harnessed and increasingly being used widely across different platforms and apps, robotics taking over tedious and difficult jobs from humans through automated machine learning. Cloud computing is easily making on demand computing accessible from anywhere, integrated with block chain technology in which computers are autonomously managing and updating records. Digital payment and banking which has eliminated the need for cash and replaced by digital transactions, and cloud data in which the information can be accessed by the user from anywhere in the world. Inclusion of all these newer technologies have shown the fast pace at which the digital enterprise transformation is rapidly evolving, and new eco-systems are reshaping the digital enterprise model.

Three prominent players are leading the transformation, which are: people (e.g., senior leaders, managers, employees & customers), digital technology (e.g. artificial intelligence, robotics, cloud computing & data, and others), and digital enterprise (e.g. dealing in products & services which are being transformed digitally). The important roles played by these players is also leading to innovation. This book focuses on all the three prominent players. The process for management and strategies for digital enterprise transformation is not straight forward and is rather complicated. This study unravels the underlying process for management & strategies to fully incorporate new digital tools and technologies across all aspects of an enterprise undergoing transformation. The chapters in this book presents interesting research in which the authors have in depth studied digital enterprise transformation at different stages and across different settings, identified key issues, analysed and made sense of vast variety of data, that provides deeper insights and for unravelling the core problems under investigation and developing solutions and recommendations and suggesting future research directions for digital enterprise transformation.

On the road to digital enterprise transformation there are many successes, difficulties, challenges, and failures that an enterprise can learn from. Failures are not an end, rather are turning points for discovering newer innovations that can stem from such setbacks. Humans are constantly evolving and at the centre of solving real world problems and driving the digital enterprise transformation and making important contribution through strategic thinking and focusing on core problems facing the enterprise. This also

means modernising the management and the strategies around digital workforce as well as customers, and to fully understand their different roles and to make the interaction seamlessly simple, through digital platform interface. Digital business is not clearly understood at different levels of management as it passes through a very complicated process. The key areas of digitalisation and global challenges that are faced during COVID-19 pandemic period are new and unique and requires new knowledge that is gained from a deep understanding of complex issues (technical e.g. technology related, & non-technical e.g. people related) that have been examined and reported in this book.

The journey for developing and completing this book is a long one in which all authors have made a valuable contribution to the body of new research knowledge, and adopted new research techniques to study the problems, and found innovative solutions to address those complicated problems. This study will be very useful for many researchers to build on new findings that have been reported in this book. This book will also serve as a valuable tool for many students, practitioners, government, managerial staff and other professionals to learn about new developments in digital enterprise transformation of business systems from a global perspective. International studies have been presented with important new findings from America, Australia, Asia, Europe, Africa & the Middle east, which demonstrates the far-reaching impact for digital enterprise transformation, and suggests that digital businesses are global and are continuously evolving online faster than ever and into new ecosystems in different parts of the world via internet.

ORGANIZATION OF THE BOOK

A brief description of each of the chapters follows:

Chapter 1 examines the business strategies adopted by transnational digital entrepreneurship (TDE) through the lens of immigrant, transnational, digital entrepreneurship and entrepreneurial ecosystem theories and practices. The paper focuses on how transnational digital entrepreneurs deploy integrated strategies in the TDE process. The paper argues proactive growth strategies and ecosystem strategies play critical structural roles in the TDE. This case study interviewed twelve Chinese transnational digital entrepreneurs in New Zealand and Australia. The results of qualitative data analysis show that transnational digital entrepreneurs rely on the resources and opportunities provided by both host and home country entrepreneurial ecosystems, and digital entrepreneurial ecosystem plays a transnational bridging role for these entrepreneurs. The results also demonstrate the traditional immigrant entrepreneurial strategies, transnational strategies, and digital strategies have been integrated and adopted by these transnational digital entrepreneurs.

Chapter 2 explores the impact that artificial intelligence will make in the education sector and how it will transform the way in which both educators and students interact in the classrooms of the future. The chapter begins with an introduction into the digital education space as well as where artificial intelligence currently sits. When it comes to the transformation of education, we explore the educator and student perspectives to ensure both sides requirements are portrayed. Both stakeholders have an equally larger learning curve and require more digital literacy than in the past, however, the transformation that artificial intelligence will bring to the table is that educators and students will likely not be trapped with repetitive tasks and can focus on being creative, learning and teaching. The three elements we explore in this chapter will give you insights into work previously completed, research being conducted and future insights and observations.

Chapter 3 reports about robots and artificial intelligence that have been touted as a vehicle for generating operational efficiency and cost savings for a business enterprise. Specifically, automated, digitalized frontline services have the potential to streamline an enterprise's service efficiency, alleviate burdens from its human employees, and enhances its relationships with the customers. Besides these cost and functional benefits, this chapter posits that robotic services can garner customers' preferences and satisfaction, that is, there are situations in which robotic services are not only a cost-saving option, but they are even preferred by an enterprise's customers. Specifically, two important drivers – social distancing and utilitarian expectations of services – can lead to customers' choosing robots over humans. This chapter concludes that deploying and managing digital and automation technologies, such as service robots, in frontline services can not only transform an enterprise's operations but also enhance its customer management and service expectations.

Chapter 4 addresses the education enterprises (e.g. schools, universities, online platforms) seeking digital transformation which require careful evaluation of their strategies and transformative capabilities. Although transformation of teaching routines is slowly evolving into student-centric learning, individual oriented learning routines (assess, evidence, credentials) are complex to manage compared to established teaching routines (define, engage, and enhance) using existing digital learning management systems. This has resulted in poor tracking of 21st century skills (21C) of learners, which are highly sought by teachers, learners and employers. Based on reviews of blockchain use cases from the education literature, this study proposes a "Blockchain for Education Learning Ledger (BELL") model to capture and track 21C skills demanded by Industry 4.0. The BELL model includes an innovative assess skills chain for developing strategic learning capabilities and enabling reconfiguration of learning outcomes.

Chapter 5 explains the Effective Innovation Leadership (EIL)-Framework, which is tested empirically. First, peer-reviewed journals in the Innovation Management, Leadership, and Transformation discipline are analyzed. Second, a pre-test with 58 executives takes place. The response behavior of the participants varies depending on the company's degree of digital maturity. Third, twenty innovation leaders employed in mature digital companies answer the survey. The participants perceive their company as innovative and state that up to 89% of created innovations are digital. Values relevant to digital innovation leaders are innovation, responsibility, positivity, and transparency. Relevant strengths are creativity and learning. Both strongly correlate with a few efficacy items. Decisiveness correlates with innovation strategy. Entrepreneurship, self-regulation, and culture correlate with each other. Creativity connects the value of innovation and the practice of communication. The insights from this chapter contribute to building a reliable and valid factor-based Effective Digital Innovation Leadership-Questionnaire in future.

Chapter 6 presents the new term called quadruple change, as a framework for delivering high-value digital transformation in organizations. The quadruple change consists of technical, organizational, social, and global change during digital transformation. The author conducted a qualitative exploratory study to explore strategies that leaders need to adopt to cultivate transformation agents during digital transformation toward establishing sustainability. The study revealed that for successful digital transformation, organizations need to empower employees, engage them in the process of change, and develop the culture of transformation in the dynamic environment. Toward this achievement, cultivating transformation agents based on quadruple change is one of the significant steps. The study findings identified seven factors contributing to cultivating transformation agents in organizations, including vision creation, mindset change, knowledge improvement, innovation development, motivation increment, leadership support, and collaboration.

Chapter 7 provides deeper insights to digitalisation of India. India has high digital ambitions despite considerable poverty, the digital divide and continued high currency usage. Digitalisation has caused both excitement and fear in India – government and companies are excited about an increase in efficiency, closing the leakages, customer confidence and satisfaction. The present study examines the role of digitalisation in the Indian economy, especially in creating a unique Digital ID (Aadhaar) and its impact on the economic, financial and payment infrastructure. The study finds major innovations in cheque processing, real time gross settlement, national electronic fund transfer, and other payment methods have considerably reduced the cost of banking facility in India. The Indian capital market has already witnessed electronic trading and settlement and has recently witnessed emergence of no-brokerage companies which can change the fundamental dynamics of the investment industry in India. The retail trade market, especially e-commerce, ride share market in India reflecting global trends has also witnessed considerable "multi-homing".

Chapter 8 investigates the important roles for elderly entrepreneurship in the context of corporate entrepreneurship, to determine its dimensions and to make suggestions with the results obtained. The systematic review method was adopted in the study. According to the findings, it has been determined that corporate elderly entrepreneurship includes innovative risk and opportunity management, innovative elderly initiative, innovative proactivity, competition management, and resource management. It is recommended to meet the needs arising due to the social, psychological, cognitive, physical, and health-related decline of elderly consumers through corporate social entrepreneurship. This type of entrepreneurship is an important approach added to the literature to meet the consumer needs that differ with the increasing elderly population. Providing the needs and satisfaction of the elderly is possible with corporate entrepreneurship. Determining the future needs of the elderly living in a nursing home or with their families requires management in innovation.

Chapter 9 is designed with the aim of analyzing digital business transformations, i.e. digital transformations that companies decide to start in order to respond to market changes. Nowadays, these changes are due to the affirmation of a new paradigm of doing business that is strongly characterized by the role of Information and Communications Technologies - ICT and Information and Communication Infrastructures – ICI. This has led to the point that digital business transformations are increasingly being considered as a topic exclusively related to information technology and engineering fields of research. In contrast with the above promise, the present research aims to investigate digital business transformations according to a managerial perspective that is often sacrificed in practice. The preponderant role of technologies often leads – in an incorrect way – to neglect the basic concepts of management that, on the other hand, persist in change and, indeed, constitute the backbone of change itself

Chapter 10 illustrates the digital strategy for youth self-employment in the digital economy. South Africa's unemployment rate is among the highest in the world with the youth being the most affected by joblessness and accounted for 63.3% of the total number of unemployed persons. A comprehensive strategy for youth employment as part of a broader focus on expanding employment is therefore necessary. This chapter assessed the status of technopreneurship development and identified key variables that determine a successful technopreneurship. Theory U, Entrepreneurship Orientation and Triple helix models were reviewed to better understand the drivers of technopreneurship development. The study identified barriers to effective technopreneurship development including inadequate funding to support young technopreneurs, weak linkages between stakeholders, lack of awareness in technopreneurship opportunities, lack of infrastructure, lack of appropriate mentors and role models. The chapter further proposed a conceptual model for successful technopreneurship development.

Chapter 11 explains that entrepreneurship has an effective position in the economic context. The positive impact of entrepreneurship on economic development, employment and welfare in societies has increased the interest of different disciplines in the concept of entrepreneurship. The concept of digital entrepreneurship has emerged as a result of developments in digital technologies, especially internet technology. The increasing volume of electronic commerce has increased the interest in digital entrepreneurship because of the increased use of the internet and the impact of social media platforms. Digital entrepreneurship ecosystem encompasses all the elements that support the development of this field. In line with this information, the conceptual framework of digital entrepreneurship will be explained and the technological applications within the digital entrepreneur ecosystem and how these applications support digital entrepreneurship will be explained.

Chapter 12 articulates that technological breakthroughs are the reasons for industrial revolution to occur. However, it may take time to exert its effects on social and technological domains. Artificial Intelligence is the branch of computer science which try to replicate human intelligence in machines that are programmed to think like humans and mimic their actions. It is acquiring increasing importance in industrial application, revolutionizing the entire industrial system enough to be referred as "Fourth Industrial Revolution". This chapter describes the impacts of Artificial Intelligence on the economy and society at large. Specifically, it analyzes the enablers and barriers behind the automatization of the working force and how the digital transformation may entail opportunities and challenges for the current economic and working dynamics as well as for society in general.

Chapter 13 demonstrates that digital enterprise transformation facilitates financial services organizations via enabling them to be more secure, compliant, as well as being digital. It modifies the experience of employees, partners, customers, and stakeholders. The contemporary world is changing very rapidly as information technology has redefined e-commerce. In its simplest sense, a baseline definition of e-commerce can be the performing of business by engaging computer networks and telecommunication aspects. In a narrow sense, e-commerce is pertinent to the commercial sphere involving transactions and people relate it to buying and selling via the internet. On a broader spectrum, it has a wider range of multiple activities. The specific definition thus used in this research curtails it as being an activity performed via a telecommunication network or the internet, which is a component of business model that generates profits and it also involves selling. It might be either one of the following, information, products (physical or digital), and services.

Chapter 14 exemplifies the Impact of digital enterprise transformation strategies on Project Managers' Competencies. Faced with increasing number of challenges that came with globalization, the developed countries have become aware of the insufficiency of traditional production systems and increased investments in technological developments in the production sector. With successive technological developments, the competition in the production sector has increased and businesses have had to undergo major changes. It was aimed with these changes to respond quickly to dynamic market conditions and customer demands. The project, which was firstly introduced by Germany as Industry 4.0, affects enterprises both technically and socially. Employees have to adapt to digitalized production systems and keep up with technological developments. In a world, where inter-business and inter-disciplinary studies and collaborations increase and operations are carried out on a project basis, project managers are obliged to adapt quickly to the continuing digital transformation. In this context, it's aimed to identify the impact of digital transformation on project managers' competencies in this study.

Chapter 15 aims to study the digital transformation strategies of public management and, within this, the analysis of the main aspects of the transformation of the public acquisition system. It is based on

the New Public Management approach, its evolution towards Post-New Public Management, as well as other strategic derived approaches, such as All Government, Good Government, United Government or Government of the Digital Age. The application of lean and agile methodologies is a great facilitator to support the digital transformation processes of public administration, and far from being incompatible, they are complementary and combinable. This work focuses on the design of strategies for the restructuring of public investment and procurement systems, a critical part of public management, making them more effective and efficient, seeking a greater rationalization of public spending, as well as avoiding waste and corruption.

Chapter 16 embodies a study on deep learning methods in the concept of digital industry 4.0. Nowadays, the main features of Industry 4.0 are interpreted to the ability of machines to communicate with each other and with a system, increasing the production efficiency, and development of the decision-making mechanisms of robots. In these cases, new analytical algorithms of Industry 4.0 are needed. By using deep learning technologies, various industrial challenging problems in Industry 4.0 can be solved. Deep learning provides algorithms that can give better results on datasets owing to hidden layers. In this chapter, deep learning methods used in Industry 4.0 are examined and explained. In addition, data sets, metrics, methods and tools used in the previous studies are explained. This study can lead to artificial intelligence studies with high potential to accelerate the implementation of Industry 4.0. Therefore, the authors believe that it will be a handbook and very useful for researchers and practitioners who want to study this topic.

Chapter 17 characterises the role of e-Government (e-Gov) which involves the use of information and communication technologies (ICTs) to achieve political goals. Innovative ICTs should be integrated in e-Gov and e-business services to maximize their potentialities/efficiency and to reduce costs. Currently, diverse conceptual models of e-Gov are purposed. These models are applied to understand and optimize governance processes. Globally, it is possible to identify a gap between e-Govs and Digital Enterprise Transformation of developed and developing countries. Digital divisions are closely related to a gap between citizens, families and businesses, regarding the access to ICT and internet in different regions. Research question: Are the international recommendations on e-government, Digital Division and Management and Strategies for Digital Enterprise Transformation producing successful outputs? Study aims are: (i) To describe and analyze international recommendations on e-government, Digital Division and Management and Strategies for Digital Enterprise Transformation and (ii) To present practical cases.

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Chapter 1
Integrated Business Strategies for Transnational Digital Entrepreneurship:
Case Studies for Immigrant Startups

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ABSTRACT

This chapter examines the business strategies adopted by transnational digital entrepreneurship (TDE) through the lens of immigrant, transnational, digital entrepreneurship, and entrepreneurial ecosystem theories and practices. The chapter focuses on how transnational digital entrepreneurs deploy integrated strategies in the TDE process. The chapter argues proactive growth strategies and ecosystem strategies play critical structural roles in the TDE. This case study interviewed 12 Chinese transnational digital entrepreneurs in New Zealand and Australia. The results of qualitative data analysis show that transnational digital entrepreneurs rely on the resources and opportunities provided by both host and home country entrepreneurial ecosystems, and digital entrepreneurial ecosystem plays a transnational bridging role for these entrepreneurs. The results also demonstrate that the traditional immigrant entrepreneurial strategies, transnational strategies, and digital strategies have been integrated and adopted by these transnational digital entrepreneurs.

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INTRODUCTION

In the last four decades, digital transformation has happened in many advanced economies. The focus of government policies and academic interests has shifted from large enterprises to SMEs, from effective operation management to digital transformation, and from existing business study to entrepreneurship research (Jurado & Battisti, 2019). Nowadays, there is a universal acknowledgement of the significance of digital entrepreneurship (DE) in achieving socioeconomic advancement (Sahut, Luca, & Frédéric, 2019). DE has advanced to a state where it is an entirely new area of research enquiry within the field of interdisciplinary entrepreneurship (Nambisan, 2017) as studied through information systems (Du & Li, 2018), economics (Richter, Kraus, Brem, Durst, & Giselbrecht, 2017), management, innovation (Nambisan, 2017), policy, education (Li, Liu, Zhang, & Li, 2017; Sandhu, 2009, 2008), strategy and sociology, in conjunction with other entrepreneurship disciplines (Zaheer, Breyer, & Dumay, 2019).

Another phenomenon that has been well-recognized is that contemporary immigrants have firm intentions to pursue transnational entrepreneurship with a high success rate (Kerr & Kerr, 2020). To explain the phenomenon, for the last two decades, researchers have developed some new positions beyond the traditional host country-oriented immigrant entrepreneurship (IE) theories (Brzozowski, Cucculelli, & Surdej, 2017; Portes & Yiu, 2013). These positions include brain circulation (Saxenian, 2005), knowledge spillover (Li, Isidor, Dau, & Kabst, 2018; OECD, 2010), cultural (ethnic) diversity (Alesina & Eliana, 2005; Audretsch, Dohse, & Niebuhr, 2010), cross-border activities (Emontspool & Servais, 2017; McDougall & Oviat, 2000) or transnationalism (Lin & Tao, 2012; Drori, Honig, & Wright, 2009), and "social network" or "transnational ties" (Brzozowski et al., 2017). All these new theories built up the foundation of transnational entrepreneurship (TE).

DE has been defined within various disciplinary contexts including internet entrepreneurship, cyber entrepreneurship (Elia, Margherita, & Passiante, 2020), information and communication technologies (ICT) entrepreneurship (Steininger, 2019; Bogdanowicz, 2015). These definitions have been used without restriction by scholars, as DE has expanded beyond national borders. This research focuses on digital entrepreneurial strategies in the context of transnational entrepreneurship (TE). It adopts the European Commission's (2016) definition, in which DE was broadly defined as new venture creation or transforming the existing organization through novel ICT innovation and/or novel usage of such innovation. The research samples are narrowed to transnational entrepreneurs who adopt digital technologies as business strategies.

TE has become a dominant research stream in the entrepreneurship discipline in the last two decades (Portes et al., 2002) along with growing international immigration, globalization and increased international trade. A widely accepted concept of transnational entrepreneurs is "social actors who enact networks, ideas, information, and practices for the purpose of seeking business opportunities or maintaining businesses within dual social fields, which in turn force them to engage in varied strategies of action to promote their entrepreneurial activities" (Drori et al., 2009, p1001). Yeung (2002, p37) further defined that transnational entrepreneurs are "capable of bearing risks in terms of capital investment and taking strategic initiatives to establish, integrate, and sustain foreign operations based on the skills of the immigrants." The cross-border economic activities conducted by entrepreneurs based on the usage of digital technology (i.e., cross-border e-commerce platforms) are defined as transnational digital entrepreneurship (TDE), and these entrepreneurs are transnational digital entrepreneurs.

Although DE and TE have garnered significant research interest recently, there is a shortage of research on TDE as to what underpins the nature and characteristics for such activities internationally. A Google

Scholar search shows no document devoted to studying transnational digital entrepreneurs. This paper tries to fill this gap by analyzing the TDE process from a business strategy perspective within a transnational digital entrepreneurial ecosystem which comprises the home and host country entrepreneurial ecosystems of entrepreneurs and the boundary-less digital ecosystem which bridges the two entrepreneurial ecosystems. The paper addresses the following key research questions: 1) What entrepreneurial and digital strategies do/should transnational digital entrepreneurs adopt in TDE? 2) What business strategies do/should transnational digital entrepreneurs deploy to take the benefits of ecosystems?

Management strategies in entrepreneurship, at their most basic, are a set of tactics to govern and guide a new venture to achieve a series of predetermined goals. They contain strategies for goal-setting, decision making, business management and operational activities (Sandhu 2009; Miles, Snow, Meyer, & Coleman, 1978). GEM (2002) recommended a necessity and opportunity dichotomy for strategic entrepreneurship research in immigrant groups (Reynolds, Bygrave, Autio, Cox, & Hay, 2002), which has been widely accepted by scholars (Von Bloh, Mandakovic, Apablaza, Amoros, & Sternberg, 2019). Following Duan, Kotey and Sandhu's (2020) TE research framework for immigration and adopting necessity and opportunity entrepreneurship typology, this study empirically investigates entrepreneurial strategies adopted by transnational digital entrepreneurs. Utilizing 12 Chinese entrepreneurs in New Zealand as the sample set, this qualitative study analyses what business strategies have been adopted by these entrepreneurs in various strategy aspects.

Researchers and policymakers now recognize that economic development is enabled by investing in developing suitable entrepreneurial ecosystems to nurture entrepreneurship. So far, available research focuses on physical entrepreneurial ecosystems and is mainly theoretical (Spigel & Harrison, 2017), while research on how digital ecosystems supporting transnational entrepreneurship has received sparse attention (Sussan & Acs, 2017). This is especially the case for transnational entrepreneurs (Song, 2019) who engage in digital strategy.

The essential findings from this research are that digital transformation promotes TDE by enabling traditional entrepreneurs to shift to TDE, and by providing capabilities that allow immigrant transnational entrepreneurs to access the networks and resources for survival in newly settled countries. This research attempts to analyze TDE through immigrant and transnational entrepreneurial strategies. The study also assesses available opportunities and resources arising from boundaryless digital ecosystems (Elia et al., 2020). In doing so, it integrates TE and DE theories to explain the role of digital systems and to examine the process of TDE.

The next section presents a background review of TE and DE from which an integrated conceptual framework of the TDE process is developed. The research methodology and qualitative case studies are presented in the third section, while the findings from the research, implications, and areas for future research follow.

BACKGROUND

Historically, TD is "an alternative form of economic adaptation of foreign minorities in advanced societies based on the mobilization of their cross-country social networks" (Portes et al., 2002, p278). The strategies executed by immigrant entrepreneurs include importing/exporting goods, investing in home-country businesses and real estate, hiring employees from the home country, travelling between the host and home countries a few times a year (Portes et al., 2002, p292). In the context of contemporary

immigrants, TE is heterogeneous which not only includes the traditional concept as Portes et al. (2002) defined, but more importantly, TE becomes a personal choice to achieve their socioeconomic goals.

The capabilities of growth and survival of immigrant ventures improve when transnational, multinational or international strategies are adopted (Dheer, 2018). TE is one of the alternatives most valued by immigrants. The strategies of setting up a cross-border business are due to the transnational capital, maintained commercial and cultural connections with the home country, other countries or regions, and the socioeconomic environments of the host and home countries (Garrido & Olmos, 2008).

Entrepreneurial strategy is portrayed as a competitive tool comprising a pattern of interrelated activities across functional areas. The typologies of strategy in entrepreneurship can be conceptualized on a continuum extending from proactive to reactive, growth/prospector to defender/survival, cost leadership to differentiation, or entrepreneurial to conservative (Kotey, Sharma, & Gao, 2013; Miles et al., 1978). Flexible entrepreneurial strategies based on needs are of significance in the success of transnational entrepreneurship (Nkongolo-Bakenda & Chrysostome, 2020). They noticed that successful transnational entrepreneurs adjust their strategies alone with venture developing. Although the family strategy may be the best suit for opportunity identification, professional service strategy is well suited for startup activity management. After business initiation, an adequate choice of competitive strategies is required, including, but not limited to, choice of partners across borders, and entrepreneurial capabilities of product/service development/adjustment through knowledge gaining (Al Amoush, & Sandhu, 2020). Customer focus strategy helps them to clarify their needs. Social network strategy keeps them to be information-rich, hence making the business flexible.

Transnational entrepreneurship can be a growth-oriented strategy (Portes & Yiu, 2013; Aldrich & Waldinger, 1990). Immigrant-owned enterprises that adopt an international strategy tend to be larger in size, have higher annual sales and higher total payrolls than immigrant-owned ventures that do not adopt this strategy (Wang & Liu 2015). Transnational strategies could be deployed for survival purposes. It could be a strategy to avoid facing disadvantages in their host nation (Shinnar & Nayir, 2019). Immigrant entrepreneurs seek benefits and improve their survival prospects by strategically exploiting their social and commercial resources through transnational ties to cater to consumers (Bazhair, & Sandhu, 2015) between the host and home countries.

Export and import activities are main transnational entrepreneurial strategies, which can also broaden the performance-enhancing social networks of transnational firms. When immigrant-owned firms start international activities, the social networks that initially enabled exports and imports become further strengthened and more valuable as a source of information and knowledge-creating social capital (Portes et al., 2002). Traditional exports and export firms and the ways of executing business have been transformed from B2B to B2C by digital renovations. Cross-border e-commerce platforms have played a key role in this transformation.

Two entrepreneurship research frameworks have recently gained considerable popularity: the entrepreneurship ecosystem (Stam, 2015; Isenberg, 2011) and the digital ecosystem (Li et al., 2017). These two frameworks were integrated into the concept of the digital entrepreneurial ecosystem (DEE) by Sussan and Acs (2017) and Song (2019). DEE offers the key components of digital infrastructure governance (DIG), digital user citizenship (DUC), digital entrepreneurship and digital marketplace within a digital economy (Sussan & Acs, 2017, p60). Within the realms of transnational entrepreneurship, DEE can offer a cross-border digital virtual environment to enable entrepreneurs to execute transnational business strategies. Entrepreneurial process analysis is the most frequently used scheme in DE, which emphasizes a cascade of entrepreneurial strategic behaviours and defines entrepreneurship as a journey rather

than an action (Zaheer et al., 2019). Literature shows that 36% of the research related to DE literature uses "process" theory, which is indicative of the fact that DE research adheres to trends seen in general entrepreneurship studies and is regarded as a subfield of the entrepreneurship discipline (He, 2019).

Transnational digital entrepreneurs take ecosystem benefits from both the host and home countries (Brown, Mawson, Lee & Peterson, 2019), and the digital ecosystem. The perceived ecosystem benefits drive immigrants to engage in TE activities. These benefits include access to resources and opportunities, ability to raise capital, capability of recruiting human capital and use of the latest knowledge and technologies. TDE strategies, in fact, include a set of plans to benefit from what the ecosystem offers to the digital, host and home countries.

The digital ecosystem, and cross-border e-commerce platforms, in particular, have become the fundamental infrastructure for transnational entrepreneurs (Kraus, Palmer, Kailer, Kallinger, & Spitzer, 2019; Nambisan, Wright, & Feldman, 2019). E-commerce platform adoption significantly and positively improves overall business performance. Compared to non-adopters, e-commerce adopters have a significantly higher sales growth rate (Abebe, 2014). E-commerce platforms not only enhance business outcomes but enable e-commerce poverty alleviation (EPA) by which poverty is eliminated (Han & Li, 2020). E-commerce platforms are welcomed by Chinese immigrants living overseas as well (Duan, Kotey, & Sandhu, 2020). Using these platforms, immigrants start cross-border business activities and become transnational digital entrepreneurs.

The currently available literature portrays an incomplete picture of TE as little research has looked into deeper issues. A considerable number of transnational entrepreneurs are necessity entrepreneurs (Portes & Yiu, 2013) and they adopt TE as ways of making a living because of being pushed into cross-border business activities by lack of access to employment opportunities in the host country. Therefore TE practitioners are more likely to pursue reactive business strategies. Conversely, other scholars have shown that a large proportion of transnational entrepreneurs are opportunity driven (Lan & Zhu, 2014; Hart & Acs, 2011), and they are supposed to take proactive growth strategies. Others (Afutu-Kotey, Gough, & Owusu, 2017) have argued that many digital entrepreneurs are necessity-driven, and DE is just a strategy for survival. So far, there is a lack of empirical studies on the key entrepreneurial strategies adopted by transnational digital entrepreneurs, a gap that will unravel important information by further exploration.

RESEARCH METHODOLOGY

Research Design

This study adopted a qualitative approach with semi-structured interviews following an interpretivism paradigm. The study follows Yin's (2002) guidance for case selections, which is each entrepreneur must engage in cross-nation business based on home-country e-commerce platforms. The qualitative method has been utilized extensively in the study of ethnic businesses (Cho, Moon, & Bounkhong, 2019; Sommer & Gamper, 2018). The method is best suited when the phenomenon is more qualitatively oriented, and an instrument for a quantitative study does not exist (Creswell & Plano Clark, 2018). Wang and Warn (2019, p.222) indicated that the in-depth interview is appropriate for its capability to explore the details of entrepreneurial activities, especially when immigrants are the research target. Scholars point to the necessity of using a qualitative approach in empirical studies of transnational entrepreneurship due to the

characteristics of transnational businesses, such as 1) the best use of the resources of two marketplaces, including producing lower costs and better quality products in entrepreneurs' country of origin while selling in developed countries; 2) the operations of these businesses are limited by their financial and human resources, and personal small and fragmented networks (Sommer & Gamper, 2018) . Wang and Warn (2019) pointed out that the interview is a better method for qualitative data collection in immigrant groups because the participants are likely to be unfamiliar with a questionnaire due to limited English skills. Meanwhile, the interviewing process would allow researchers to build trust with the interviewees.

Sampling and Data Collection

Snowball and opportunistic sampling techniques were adopted for the recruitment of respondents. Twelve transnational digital entrepreneurs were recruited. Four of the respondents were reached via the author's networks. The other eight of interviewees were reached through snowballing. To ensure confidentiality, all interviewee names were coded in the research process (e.g. GG, CY and JH) (Table 1).

Data collection was done via two methods: face to face and telephone interviews with entrepreneurs. This study focused on immigrant entrepreneurs who had already initiated a cross-border e-commerce platform-based transnational business with successful business growth and income. This allowed the researcher to gain the trust of the participants. Among the 12 interviewees, three were profile entrepreneurs, three had off-line retail shops while engaging in transnational trade, one was a student to make money for her living, one was a housewife earning extra income, and one was an Alibaba and WeChat technology distributor.

Analysis Process for Interview Manuscripts

The data analysis followed a theoretical framework proposed by Dual, Kotey and Sandhu (2020), in which the process is conceptualized as an integration of three ecosystems: digital, host-country and home-country entrepreneurial ecosystems. They argue that TDE strategies need to be investigated from various aspects, including transnational entrepreneurship strategies in the host and home-country context, digital ecosystem strategies and entrepreneurial ecosystem strategies. The analysis of manuscripts in this study with 12 entrepreneurs started with analyzing transcripts and a systematic coding process (Figure 1), which resulted in 38 strategy-oriented codes. These codes were later classified into five themes: immigrant entrepreneurship, transnational entrepreneurship, digital entrepreneurship, host-country entrepreneurial ecosystem, host-country entrepreneurial ecosystem, and Chinese culture and local co-ethnic community. To ensure the feasibility of thematic analysis procedure, two theme revisions were taken at theme-code level and theme-transcript set. These revision procedures reinforced the acquaintance and understanding of captured data.

Classification and coding are two key data analysis processes in the study. Categories can be conceptualized as pillars in an EE framework. For example, "family financial support", "borrowing from friends" or a "gift from parents" will be grouped under the domain "funding and finance". Isenberg's (2011) EE framework was applied for the process since the framework already provides the required categories. In Isenberg's (2010) framework, there are six domains in an entrepreneurial ecosystem: funding and finance, government and institutional policy, market, human capital, business support and entrepreneurial culture (Table 2).

Table 1. Profile of interviewees

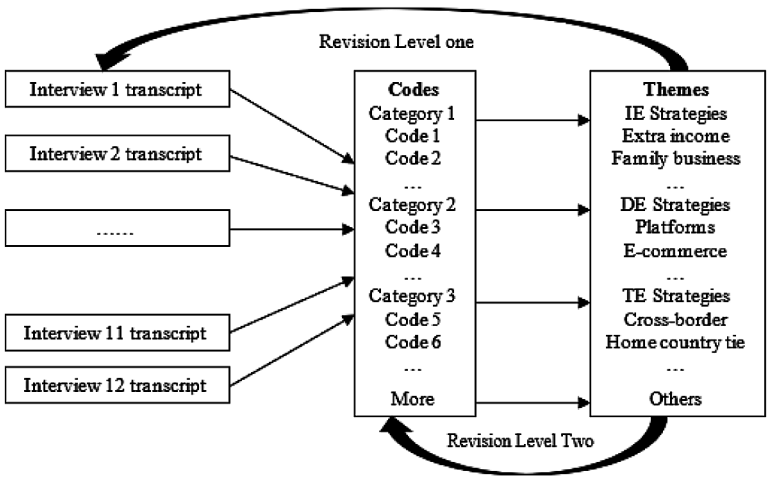
Identifier	Age	Gender	Year of Migration	Year of Startup	Occupation Before Startup	Business Activities	Strategy Posture and Entrepreneurial Motivation
JW	50	M	2015	2015	Job hunter	Transnational trade.	Proactive/Necessity
GG	20-30	F	2010	2016	Student	Transnational trade, partner with off-line shops.	Proactive/Necessity
CY	40-50	F	2014	2014	Housewife	Transnational trade, partner with off-line shops.	Reactive/Opportunity
JH	35	F	2016	2016	Working holiday in NZ	Transnational trade.	Proactive/Necessity
NN	40-50	M	2002	2012	Professional position	Transnational trade, partner with off-line shops.	Proactive/Opportunity
Jenny	35-45	F	2014	2014	Job hunter	Transnational trade, partner with local suppliers. Being a member of E-commerce business association.	Proactive/Necessity
WY	40	F	2014	2014	Entrepreneur visa holder	Transnational trade, partner with off-line shops.	Proactive/Necessity
Luna	30-40	F	2013	2017	An employee in an e-trading firm	Transnational trade, partner with off-line shops.	Proactive/Opportunity
Annie	40-50	F	2013	2017	Housewife	Transnational trade.	Proactive/Necessity
Andrella	30-40	F	2014	2015	Professional position	Transnational trade. Being a member of E-commerce business association.	Proactive/Opportunity
ZK	40-50	F	2012	2018	An employee in an e-trading firm	Transnational trade.	Proactive/Opportunity
SZ	34	M	2002	2015	Business owner	Transnational trading technologies diffusion (WeChat pay and Alipay)	Proactive/Opportunity

DATA ANALYSIS AND RESEARCH FINDINGS

This section provides research findings from the perspectives of transnational digital entrepreneurs. First, it presents the group characteristics based on data analysis. Second, it focuses on how transnational digital entrepreneurs adopt business strategies to achieve their ultimate goals. The results are catego-

rized according to various immigrant, transnational and digital entrepreneurial strategies and strategic outcomes. Third, the section depicts how the transnational digital entrepreneurial ecosystem influences the entrepreneurial process.

Figure 1. Data analysis process for interview manuscripts
(Own Elaboration)



Group Characteristics Analysis

The respondents share strong connections both socially and culturally to their home-country ecosystems, despite being located in a different geographical location and socially embedded within the host-country ecosystem. These entrepreneurs have the strategic capability to seize opportunities and access available resources from both ecosystems.

Chinese transnational digital entrepreneurs in NZ are generally well-educated contemporary immigrants. They most likely moved to NZ in the new century. There were no second-generation migrants in the sample set in this research as it was hard to recruit one. One possible reason may be that they had lost strong ties with their home country (De Vries & Kantor, 2013). Ten interviewees all have a Chinese university degree, and two gained their tertiary education in NZ. They had various backgrounds from students to business owners to professionals prior to and after migration before they started their transnational business ventures. All of them have good English communication skills.

Eleven of the twelve attendees migrated to NZ after 2010. By then, e-commerce trading had become popular (Yue, 2017). Therefore, they understood and experienced internet trading tactics. They are familiar with and have skills to use modern ICT equipment such as cellphones, the internet, computers, etc. Only one attendee (NN) migrated to NZ before 2010, he also had knowledge about transnational e-commerce trading and was familiar with the latest ICT technologies.

The Ministry of Commerce, NZ (1999) defined that a small business has up to five employees (excluding the business owner), the medium-sized enterprise has 6–19 employees (excluding the owner). They further defined an SME means ‘a firm with up to 19 employees. By this standard, only three attendees operate in medium-size enterprises, and others are running small businesses. Seven of them are sole trad-

ers (micro-enterprise) or in a family business. By the standard of the Global Startup Ecosystem Report (2020), these self-employed entrepreneurs with family member help are classified as micro-entrepreneurs.

Most of the interviewees were undertaking proactive business strategies to accelerate business growth (Figure 2). Only one took reactive strategies in that she only took orders from existing customers and stopped recruiting new ones because of family issues.

Table 2. List of components and factors in an EE framework

Funding Finance	Policies	Accessible Markets	Human Capital	Supports	Culture
CAPITAL •Micro-loans •Angel investors, friends, family •Zero-stage venture capital •Venture capital funds •Private equity •Public capital markets • Debt	LEADERSHIP •Unequivocal support •Social legitimacy •Open door for advocate •Entrepreneurship strategy •Urgency, crisis, and challenge GOVERNMENT •Institutions e.g. investment and support •Financial support e.g. for R&D, jump start funds •Regulatory framework incentives e.g. tax benefits •Research institutes •Venture-friendly legislation, contract enforcement, • property rights and labor protection.	EARLY CUSTOMERS •Early adopters for proof of concept •Expertise in productizing •Reference customer •First reviews •Distribution channels NETWORKS •Entrepreneur's networks •Diaspora networks •Multinational corporations	LABOUR •Skilled and unskilled •Serial entrepreneurs •Later generation family •General degrees (professional and academic) •Specific entrepreneurship trainings	INFRASTRUCTURE •Telecommunications •Transportation & logistics • Energy • Zones, incubators, co-working, clusters SUPPORT PROFESSIONS •Legal •Accounting •Investment bankers •Technical experts, advisors NON-GOVERNMENTAL INSTITUTIONS •Entrepreneurship promotion in non-profits •Business plan contests •Conferences •Entrepreneur-friendly Associations	SOCIETAL NORMS •Visible successes •Wealth for funders •International reputation •Tolerance of risk, mistakes, failure •Innovation, creativity, experimentation •Social status of entrepreneur •Wealth creation •Ambition, drive, hunger

(adopted from Isenberg, 2010)

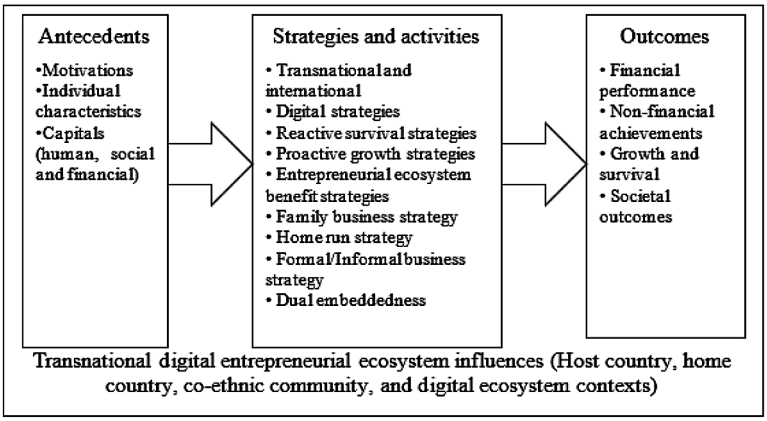
Transnational Digital Entrepreneurship Strategies

Based on the theory of necessity and opportunity entrepreneurship, both necessity and opportunity-driven transnational digital entrepreneurs were identified from the cases. However, no clear standard strategies or business models were associated exclusively with either type of entrepreneur. Jenny, GG, JW and Annie were typical cases of necessity entrepreneurs since they need the income to support their families, travels or studies in the host countries. One particular subtype of necessity entrepreneurs was business visa holders (WY and NN) who were involved in transnational entrepreneurship not necessarily to earn income to survive, but as an avenue for immigration. Two interviewees who belonged to this group were not only trading on e-commerce platforms but also had local shops with employees in the host country. In contrast to the necessity entrepreneurs, SZ, Andrella and CY are typical opportunity entrepreneurs, driven to pursue identified opportunities. Other motives for engaging in TDE were mentioned such as

to help family members (Jenny), to maintain personal networks in the home country (Andrella), and to earn money to travel (JH).

By analyzing twelve transcripts with the conceptual framework created for the study, the authors identified fourteen unique strategies within three TDE strategy themes (Figure 2). The first strategy theme is strategies for immigrant and transnational entrepreneur entrepreneurship, which include six strategies adopted by the entrepreneurs. The second category is the digital ecosystem strategy theme, which includes digital strategies being used by entrepreneurs. The third is the entrepreneurial ecosystem strategy theme, which includes strategies to take benefits of six ecosystem pillars. The motivations mentioned above drive these entrepreneurs to pursue various business strategies. Transcripts show that the strategies adopted by respondents have the roots of IE, TE, DE and general entrepreneurship strategies. The case studies also show that some entrepreneurs strategically take the benefits of entrepreneurial ecosystems (Brown et al., 2019). They see the benefits of the entrepreneurial ecosystems as a lure of the startup accelerator. These benefits include all perceived benefits of engaging in entrepreneurship such as host-country government support programmes, home-country accessible markets and others.

Figure 2. Transnational digital entrepreneurial strategies



Immigrant and Transnational Entrepreneurship Strategies

Formal and Informal Strategies

Informal business activities encompass those doings for which the terms of regulation and legislation applicable are not being met, aimed at creating positive financial benefits for suppliers and receivers. "although this definition encompasses criminal activities, the term is customarily reserved for such activities as those in the food, clothing, and housing industries that are not intrinsically illegal but in which the production and exchange escape legal regulation" (Ports & Sassen-Koob, 1987, p31). Thus, the informal economic activities are conceived as processes of income generation rather than a characteristic of an individual (Kloosterman, Van Der, & Rath,1999). From entrepreneurial strategy perspectives, both informal and formal business strategies equally play essential roles in cross-border economic activities. In some cases, the entrepreneurs treated their businesses as part-time jobs (CY, GG, Andrella) for extra

income, while others engaged in traditional formal businesses with offices and stores, putting every effort (full-time, social and economic capital) into the business (WY, SZ) to succeed. The majority of cases pursued their cross-border business activities as informal businesses. Few expressed that formal business models and trading rules are not necessary for modern online businesses.

Home Business Strategy

In addition to informal characteristics of transnational digital entrepreneurs, the "home run" strategy (Ndofor, 2011) is popular in e-commerce platform-driven entrepreneurship. Of the 12 interviewees, only four have offices or shops in business areas. The others run their online trading from home. Few have product stocks in their garages. Most of them are intermediaries in a business cycle or a trading hub. Jenny expressed that she used to have stocks in her home and was responsible for packing and sending the products overseas, but that is no longer the case. Now, she receives orders through e-platforms and sends the orders to different suppliers/shops. The suppliers then send the goods to the end-users directly.

Family Business Strategy

Involving family members in the business (Ndofor, 2011) is common in TDE. In particular, female-owned businesses were, in actual fact, family-owned businesses. Family members, particularly husbands for married women, played crucial roles in decision making and execution of strategies. Eight interviewees admitted that family members, in both the host and home countries, were involved in their businesses. Family business theories (Peterson & Crittenden, 2020) are, therefore relevant to TDE. Accordingly, these family businesses generally have very low-profit margins (Garrido & Olmos, 2008). The low margin and low-price strategies increase the competitive advantages of transnational digital entrepreneurs.

Social Capital Strategy

Another effective strategy is utilizing social network capital (Norfor et al., 2011). The most commonly used social capital is WeChat "Moments". All interviewees see "Moments" as an effective strategy for promoting their products and services. GG, CY, JW, JH and other interviewees expressed the significance of social networks. The networks were not limited to the entrepreneur's personal networks. The marketing effects were amplified by the networks of family members and close friends. Some of them (Jenny, Andrella) went as far as forming partnerships with people in China to create larger social networks.

Female Immigrant Entrepreneurship Strategy

It is of significance to classify female entrepreneurship as a separate TDE strategy due to most of the respondents being women (9 out of 12). Literature shows that women immigrant entrepreneurs operate mainly within ethnic enclaves (Biernacka et al., 2018) due to accumulated pressure of race and gender discrimination and they often apply a family or an independency strategy in business creation, but a mixed strategy is also revealed (De Luca & Ambrosini, 2019). Female entrepreneurs are also keen to use social media (e.g. WhatsApp, Facebook) as business promotion tools (Jose, 2018).

One strategy preferred by female immigrants is to work as a team with family members (spouse, adult children) or close friends (Chreim et al., 2018) and is named "connective strategies" or "family defender

strategy (p37)" which provides work to family members, has flexible time to look after children, and stabilizes and legalizes the immigrant status (Andrejuk, 2018; Biernacka et al., 2018). Family members, mostly husbands, play a key role in providing advice, making decisions, obtaining funding and business execution (Chreim et al., 2018).

Female entrepreneurial strategy is of importance within Chinese TDE practitioners in NZ and is closely related to the family business approach. The reasons that female entrepreneurs play the majority portion of TDE can be all the above mentioned and a few extra explanations. First, Chinese women have close relationships with families. As a strategy, it is easier for them to leverage human capital from their families. Second, female entrepreneurs have advantages dealing with customers in the home country due to the products they are trading, which are mainly NZ character goods such as food, healthcare and skincare products. Women are predominant in these product ranges in every culture. Finally, Chinese women have bigger social networks compared to men and that makes female entrepreneurs easier to be successful.

Digital Ecosystem Strategies

Digital ecosystem strategies are transnational digital entrepreneurs' strategies to take benefits from the digital ecosystem. The interviewees treated the digital ecosystem as a strategic information system. The digital ecosystem plays key roles in the business operations of transnational digital entrepreneurs as facilitators and mediators, a position consistent with the roles proposed by Sahut et al. (2019), cross-border e-commerce platforms in particular. The results indicated that entrepreneurs strategically utilize digital e-commerce platforms as their venture creation enablers, and transformers of the traditional off-line business model. The finding also shows that the entrepreneurs treat digital technologies as intermediaries, by which entrepreneurship can be carried out using opportunities generated by the digital ecosystem.

This unique digital business environment enables the digital ecosystem to play four key roles in the business operations of transnational digital entrepreneurship: a facilitator, a mediator, an outcome and a ubiquity (Steininger, 2019). This is consistent with the role classification offered by Sahut et al. (2019) of digital technological functionalities. The respondents indicated that digital technologies act as enablers, via which new ventures can be created, and traditional firms can be transformed. Digital technologies also act as outputs (Sandhu, 2008), by which entrepreneurship can be carried out on opportunities generated by digital innovation and new venture creation.

The respondents strategically interacted with different e-commerce platforms. They used one platform (Taobao) for necessary products such as dairy products and another (Tmall) for luxury products such as wine and health substitutes or complements. They treated E-commerce platforms as a knowledge base for customer consumption behaviour, information of similar products, price and logistic competitiveness. They adjust their product information instantly, including product range, price and product description.

Few respondents (GG, ZK) complained about trading costs of e-commerce platforms and moved to network market through social media platforms such as WeChat Moments. The switch is also because of uneasiness to change product information, particularly, the price. They expressed that they lost business because it took too long to update the price; hence customers shifted to other suppliers. They also believed they have to constantly monitor the platforms for the changes in competitors' products and change their product information accordingly. These activities are competitive strategies conducted by most of the interviewees.

All respondents, regardless of doing international trade or technology diffusion, were utilizing WeChat Moments as a marketing application. Building up a large number of effective Moments groups was significantly important. The product information is broadcast out through these groups and exponentially amplified by group members passing it to more groups. WY indicated an increasing the number of groups is only half of the marketing job; the more important part is to create product information that attracts consumers' attention to read on the cellphone. She relies on other APPs, such as HTML5 campaigns to increase consumers' engagement. Therefore, TDE conductors rely on the entire digital ecosystem from interface equipment to internet to platform.

Entrepreneurial Ecosystem Strategies

Entrepreneurial ecosystem strategies are strategies that transnational digital entrepreneurs adopted to take the benefits, access and use resources and opportunities provided by immigrants' host and home countries. Regarding entrepreneurial ecosystem pillars, scholars have inconsistent frameworks (Brown, Mawson, Lee, & Peterson, 2019; Stam, 2015; Isenberg, 2011). Although each EE framework has a different number of pillars, they all try to cover social, economic, political, and cultural business environmental factors. Isenberg's (2011) six pillar EE framework is widely accepted by scholars, governments and organizations. Based on these frameworks, the World Economic Forum (2020) and Ndofor and Priem (2011) recognized the relative importance of entrepreneurial ecosystem pillars to entrepreneurs. They agreed that the big three are accessible markets, human capital/workforce and funding and finance.

Strategies to Policies

This study shows a new strategy adopted by some transnational digital entrepreneurs. It is named "entrepreneurial ecosystem strategy" defined as entrepreneurs leveraging ecosystem components to strategically enhance business performance. In the NZ case, for example, there is a policy of "Market development tax credits" which allows transnational entrepreneurs to get a 15% tax refund for exporting goods and services to countries beyond NZ and Australia (OECD, 2019). The policy is dedicated to all NZ SMEs whose annual turnover is less than $50 million.

Tax policies in the exporting industry of the host country had enormous impacts. By NZ tax policy, business owners can claim paid GST back for business activities. There is a wide range of claimable items from car to laptop to council rates. FTA is an ecosystem promoter for NZ transnational digital entrepreneurs who are benefiting from both host and home countries. Few interviewees see this policy as significant for their entrepreneurial motivation and execution. Jenny, WY and Ellen all had similar expressions. These findings are consistent with research from Shinnar and Nayir (2019) for transnational entrepreneurship starting their venture in emerging economies. The Global Startup Ecosystem Report (2019) also reported that the tax incentives are a significant promotor of economic activities (Genome 2019). Other researchers noticed that these tax benefits could be discrediting myths (de Oteyza, Echevarren, & Gomez, 2015). They also pointed out that these myths fall under their own weight when considering that the essential precondition for the incentives is to pay all social expenses.

Some TD entrepreneurs expressed concerns about the government policies, including a lack of clear government regulations in both host and home countries regarding trading on cross-border digital platforms. Others noted the low entry barriers to trading on the platforms, exposing participants to severe competition. A conservative strategy, involving cautious investment in growth activities, was therefore

preferred. Nonetheless, some respondents noted availability of considerable opportunities in TDE through e-commerce platforms, with China's opening trade to the world and the trend of globalization.

Strategies to Accessible Market

The home-country accessible market was of significance to all interviewees. The most important components of the home-country ecosystem were identified as market demand for trendy competitive products with excellent quality and reputation. All respondents were targeting the world largest middle-class population in China because of the market size, accessibility and taking advantage of understanding the people. A number of interviewees expressed this opinion and had a perception that the NZ market is limited by its population.

Three entrepreneurs own shops in NZ in which they are selling unique products as they do through e-commerce platforms. These local shops target two special market niches. The first is Chinese tourists and students coming to NZ for short term visits and purchasing some NZ products for personal consumption or as gifts for friends and family members. The second is local Chinese immigrants purchasing NZ products for gifts for relatives before they visit China. It is the Chinese custom to bring home some special products as souvenirs. The first niche can be classified as an accessible market from the home country, and the second is from the co-ethnic group. Both niches have same end consumers in entrepreneurs' home country.

Strategies to Funding And Finance

The transnational business models enabled by the digital ecosystem have dramatically dropped the initial funding requirement. Over half of the respondents reported "lean startup" strategies or being already transformed to minimum financial needs apart from basic office equipment. Compared with a previous study conducted in NZ for non-digital Chinese entrepreneurs (Spoonley & Meare, 2009), the digital entrepreneurs are obviously less financial burdens.

Personal savings through hard work and thrifty living prior and after migration seems a practical strategy to many respondents. None of the interviewees took loans or funding from local banks or financial institutions but they did borrow initial funding from family members and friends in China and NZ. This behavioural finding is consistent with the Chinese entrepreneurial behaviours in Italy (Zhang & Zhang, 2016). The behaviour is closely related to the Chinese culture of family solidarity (Refer to the next subsection), in which all family members support each other. These entrepreneurs treat business creation and growth without bank loans as risk control strategies.

WY reported she had extra funding from a Chinese immigrant who holds an entrepreneur visa. People who migrate to NZ with this visa type, have to engage in entrepreneurship and employ three NZ citizens, or invest in an existing company which hires three more employees. Relying on this investment, she increased her local shops from one to three. She also expanded her services to serve other transnational entrepreneurs by providing product sourcing, packing and logistic management.

Strategies to Culture/Societal Norms

Building social networks is of importance for trading in the Chinese market. In Chinese culture, relationships are important human capital. Networks and relationship-based strategies (guanxi) feature

prominently among Chinese businesses (Kotey et al., 2013). Creating strong ties (guanxi) with family members, friends, and relatives is definitely an essential business strategy adopted by entire groups of interviewees. As a previous family business section discussed, the family business is an essential business model adopted by TDE executors. Sometimes family members in China were volunteers to support the entrepreneurs' business through product marketing as GG reported.

The strategies in dealing with social norms are various. A few interviewees (NN, JW) mentioned working hard, thrifty living and saving hard as strategies for business initiation capital. Annie saw these strategies as surviving tactics. To avoid the culture differences between Chinese values and Western values (Kotey et al., 2013; Chen & McQueen, 2008), all employers, but one (SZ), took avoidance strategies by employing Chinese immigrants only. Learning from and helping each other's strategies were found from three entrepreneurs in one church group.

Strategies to Human Capital/Workforce

In addition to building up human capital through Chinese social culture norms as the previous subsection mentioned, joining local or overseas e-commerce associations was found to be an efficient strategy for cost-saving and business productivity, Jenny reported. She joined an e-commerce association across NZ and Australia, through which she can achieve a higher level of price discount because of the negotiating power of the organization.

Partnership with entrepreneurs in the home country has been a strategy reported by respondents. Few entrepreneurs (Jenny, Andrella) expressed that they grew their business through partnership strategy. This partner relationship was not formalized and bound with legal responsibilities; instead, it is an informal relationship based on trust. Frequently, the partners are having a close relationship with the entrepreneurs. They share business profits by deals.

Strategies to Business Supports

The host country's product supply was essential for all interviewees. The entrepreneurs expressed that operating from the host country had enabled them to upgrade the information of their products, relying heavily on natural, clean, good quality products to meet customer demand in the home country. These cross-border traders mentioned business support (accounting, associations) in the host country as important to their success. One believed the business association of which she is a member helped her to carve an appropriate business model and achieve profits. In general, these entrepreneurs recognized support from the host entrepreneurial ecosystem.

For entrepreneurs, NZ has an excellent entrepreneurial environment to help their business creation and growth. In 2018, NZ ranked first on the list of the Best Countries for Business by Forbes (Badenhausen, 2012). New Zealand is the number one country in the world for ease of doing business with the shortest time to start a business and the number one globally for corruption transparency (Genome, 2019). The NZ entrepreneurial environment is welcoming, and it also has a stable government support system in place to help entrepreneurs in line of further business growth.

SOLUTIONS AND RECOMMENDATIONS

Transnational digital entrepreneurship, particularly how the digital ecosystem is bridging immigrants' host and home countries for transnational economic activities, has not been examined theoretically or empirically. This paper is the first attempt to analyze the strategic associations between entrepreneurs and digital technologies based on a TDE process framework. The findings have led to developments in the fields of TDE through evidence regarding the causal effect among entrepreneurial decision making, strategies, outcomes and the TDE ecosystem. The new understanding of the TDE process and success strategies contributes to the TE and DE literature by adding up new knowledge to the discipline. The findings also reveal how entrepreneurs strategically take ecosystems' benefits in a transnational context. The implication of government policies and programmes potentially impact all transnational entrepreneurs (Sussan & Acs, 2017).

This research adopted a TDE investigating model of three ecosystems in which the entrepreneurs are embedded and engaged within. The ecosystems are the host and home-country ecosystems in which the businesses activities are conducted and the digital ecosystem by which two location-specific ecosystems are bridged. It can be imagined like the host and home-country entrepreneurial ecosystems are computer hardware and the digital ecosystem is the operating system. The model was tested with 12 cases of transnational digital entrepreneurs, comprising Chinese immigrants residing in Australia and NZ, using the popular Chinese e-commerce platforms of WeChat and Taobao to engage in transnational trades. A major contribution of the research was exploring the strategies deployed by transnational digital entrepreneurs to take benefit of three ecosystems.

There is keen interest amongst immigrants to initiate cross-border business activities between their host and home countries (You et al., 2019; Lin & Tao, 2012), by taking benefits from the two different ecosystems. Transnational digital entrepreneurs are able to make the best of the benefits provided by both home and host countries through e-commerce platforms. First, immigrants have a close sociocultural association and advantage when they engage in trade with their home country because of established "bounded solidarity and enforceable trust" (Portes & Sensenbrenner, 1993, p1325). Second, being a Chinese immigrant engaging in trade on Chinese platforms where the clientele are mainly Chinese, the transnational digital entrepreneurs are at a distinct competitive advantage regarding market knowledge and product recognition compared to foreign operators.

The research demonstrated that the ecosystem significance of the home country such as technology development, infrastructure advancement and home-country business support services, have direct impacts on business strategies for transnational digital entrepreneurs. It confirmed that TDE is impacted by both host and home-country entrepreneurial ecosystems and that digital ecosystems function as a bridge connecting the home and host ecosystems.

Some entrepreneurs expressed concerns about the ecosystems, including lack of clear government regulations in both host and home countries regarding operating on the e-commerce platforms. Others noted the low entry barriers to trading on the platforms, exposing participants to severe competition. A conservative strategy, involving cautious investment in growth activities, was therefore preferred. Nonetheless, some respondents noted the availability of considerable opportunities in TDE through e-commerce platforms, with China's opening trade to the world and the trend of globalization.

Finally, the digital ecosystem enhanced transnational trade by reducing travel between the home and host countries and extending networks and social capital, without the deep embeddedness in home and host countries required in traditional international trade (Drori et al., 2009). Transnational digital

entrepreneurs were therefore allowed to pursue a lean startup strategy with a significant reduction in the capital and knowledge capital required in international trade. The digital ecosystem, therefore, plays a vital role in the integrated strategies of TDE.

FUTURE RESEARCH DIRECTIONS

The findings diverge from the conventional view that necessity entrepreneurs have limited access to resources (finance, human, social) to enable active participation in transnational activities. The case studies presented highlight that the theory of blocked mobility does not apply to the TDE phenomena in an digital ecosystem which is essentially boundaryless. Digital platforms have permitted necessity entrepreneurs to conduct business in the exact same manner as opportunity entrepreneurs. These platforms transform the challenges faced by both types of immigrant entrepreneurs into strengths in transnational environments. The main limitations of the study are the small sample size, use of the qualitative research approach and focus on Chinese transnational digital entrepreneurs in NZ. Future research could test the global application of the proposed framework in extensive studies involving quantitative analyses.

CONCLUSION

It can be concluded that digital technologies enhance TDE in three crucial ways. First, they promote TDE by providing access to various resources including knowledge capital, technology, market access and financial capital to ease entry and operations for the entrepreneurs. These resources become immediately available directly to transnational digital entrepreneurs without intermediaries. Second, the DE interact with transnational entrepreneurs to grow their incomes by improving international trade. The conventional view that only capital-rich entrepreneurs have the capability to engage in international trade does not hold in the context of digital entrepreneurship. Finally, DE enhances the entrepreneurial lean startup capability of immigrants, with minimal capital requirements, especially for resource-scarce new immigrants. Immigrant entrepreneurs with the advantage of knowing the markets, customers and cultures in both home and host countries are empowered by the DE to turn their foreignness status in their host countries to transnationalism.

The entrepreneurial strategies for TDE can be divided into three themes: immigrant and transnational entrepreneurship, digital ecosystem, and entrepreneurial ecosystems. The strategy models for traditional immigrant, are still effective, include strategies of formal and informal business activities, a home run and family business, and social capital and dual embeddedness strategies. The research singled out female entrepreneurial strategy as a unique TDE strategy for Chinese transnational digital entrepreneurs with causal-effect analysis. Although each immigrant group may deploy slightly different strategies for new venture growth, the research method and results are generic knowledge which can be applied to other groups of transnational digital entrepreneurs.

Transnational entrepreneurs normally take proactive business strategies to engage in TDE, but depend on personal situation changes. Some entrepreneurs started TDE with a proactive strategy and turned to a reactive strategy after the business reached a turning point such as personal needs or goals met. Others may start with reactive strategies such as only engaging in business whenever family members, friends or relatives have trade requirements, and later they turned to a proactive strategy when they see

the trade producing attractive benefits. The business strategy can also be changed by other reasons such as family reasons.

Transnational entrepreneurs utilize DE as a strategy to bridge their host and home-country entrepreneurial ecosystems. Through digital technology, transnational entrepreneurs can easily access home-country marketplaces, human capital, funding and finance, and business support infrastructure such as e-commerce platforms. Traditional immigrant entrepreneurship strategies still play key roles in TDE. The home-country government policies encouraging their citizens to travel and study overseas also help these entrepreneurs' business performance. The policies of promoting micro-entrepreneurship in the home country helped transnational entrepreneurs to find partners in the home country. The culture of family solidarity has been a solid business strategy being utilized by interviewed entrepreneurs.

The entrepreneurs strategically benefit from the host-country ecosystem. The most obvious benefits from the host-country ecosystem are exporting promotion programmes and the GST refund policy. Joining host-country professional associations is a strategy for entrepreneurs to enlarge profit margins through the power of group negotiation with suppliers. To avoid culture conflicts, Chinese entrepreneurs prefer an avoidance strategy by employing co-ethnic people only. These entrepreneurs normally fund their business initiation by personal savings or borrowing from the family in the host or home countries. They see business growth with bank loans as a risk control strategy.

This study contributes new knowledge to the DE literature by integrating it into a new concept of transnational digital entrepreneurship. In addition to the traditional interest in opportunity-driven DE, the study argues that necessity digital entrepreneurs should also be investigated in TDE research. This research identified differences in motivational influences between the two types of entrepreneurs, which translate into different outcomes, although e-commerce platform strategies are similar among the two types of entrepreneurs.

In addition to adding knowledge to the DE literature, this study contributed to the TE and immigrant entrepreneurship literature. It emphasized the role of e-commerce platforms in linking immigrant transnational entrepreneurs to their home countries to take advantage of resources and opportunities in both the host and home countries. The paper argues that immigrants gain a distinct advantage through the ability to make use of home-country technology and infrastructure for their businesses in addition to resources from their host countries.

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Chapter 2
Artificial Intelligence and the Transformation of Digital Education:
Robotics, Student Skills, and Learning Analytics

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ABSTRACT

This chapter explores the impact that artificial intelligence will make in the education sector and how it will transform the way in which both educators and students interact in the classrooms of the future. The chapter begins with an introduction into the digital education space as well as where artificial intelligence currently sits. When it comes to the transformation of education, the authors explore the educator and student perspectives to ensure both sides requirements are portrayed. Both stakeholders have an equally large learning curve and require more digital literacy than in the past; however, the transformation that artificial intelligence will bring to the table is that educators and students will likely not be trapped with repetitive tasks and can focus on being creative, learning, and teaching. The three elements they explore in this chapter will give insight into work previously completed, research being conducted, and future insights and observations.

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INTRODUCTION

Artificial Intelligence (AI) is emerging in almost all sectors of industry, including finance, retail, manufacturing and farming to name a few, and will likely become much more visible to the average employee within the next 5-10 years (this being 2020) as developments grow. Education is one sector where AI could and likely will have a massive impact as it encompasses a lot of administration of large groups of people and tasks, such things as grading of assessments and uploading of results; creating schedules for classes; creating teams and analyzing skills for student projects; creating and teaching learning resources and trying to determine students' academic progress, to name a few key areas of likely impact. Thus, an important focus and aim of this chapter will be looking at how AI is going to transform the education sector and how that will be managed effectively by exploring three key important elements. This chapter provides insights and discoveries which have come from three multi-award-winning academic experts with findings from a number of digital education and AI research projects, published research papers in AI, secondary data from literature reviews, personal future insights and observations in the sector, which will address three main research questions:

- what opportunities will robots with AI create for educators and students?
- what benefits can AI bring to the table when it comes to student professional skills and team allocation for assessments? And
- what can we learn from student data to better understand students and make predictions about their progress.

BACKGROUND

Education has been a mainstay for most cultures around the globe and is seen as a progressive ladder for human society because it aims at ensuring cultural heritage and social development Wang et al. (2018). The state of education some might say has been relatively the same across the past 20 years from a technological sense, however in terms of educational theories and methodologies these are always being pushed to the forefront, such approaches like flipped learning and active learning have had a resurgence of late. Educational goals are shifting away from preparation for the workforce in terms of a rigid body of knowledge and on to giving students access to tools and skills which allow them to become experts and on-the-job learners (Common Core & NGSS as cited in Roll & Wylie, 2016) where technological skills like digital literacy and a comprehension of AI will be paramount. While technology moves at a rapid pace and it has embedded itself into education, it has not kept up with the rate of speed in other industries. Major transformations have been with the advent of innovative learning management systems like OnTrack (Cain, 2020) and online learning through avenues like MOOCs delivered on platforms like FutureLearn (Nelson, 2020). These digital resources and trends have come about as the result of high-speed internet and mobile technology strategies (Roll & Wylie, 2016) becoming highly accessible globally, specifically where nearly 50% of the world is online (Hern, 2018).

Advanced technology is a rapidly changing venture and has worked its way into almost every field, including the education sector, usually due to educators being unhappy with the first generation of digital learning environments and looking for alternatives (Cope, Kalantzis, & Searsmith, 2020). So educational technologists tend to look to see what advances there are in technology and see how that

can be integrated with education, and when we look for the next significant digital transformation that is bound for the education space, we can look no further than that of new generation AI tools and systems, as they have been introduced and used in nearly all other industries and trades in some shape, form or another (Wang et al., 2018).

Research on educational systems which use AI have been exploring key questions, for example how to support learning and problem-solving which really sits at the heart of human intelligence and how to communicate with people (Wenger as cited in Nagao, 2019). Now, the current and future trends are shifting towards possible areas related to educational COBOTS (Collaborative Robots) which assist teachers in the classroom and smart classrooms which make use of sensors to support learning (Timms, 2016). COBOTS were invented in 1996 by two professors at Northwestern University and came about from a result of a General Motors grant program in 1995 (Shravani & Rao, 2018). They focused on trying to find a way to make robotic equipment safe enough to team up and work alongside humans. They discovered that robots can be much more effective when they are working alongside a human and present benefits over autonomous robots such as greater collaboration without fear of accidents, as these robots can detect the presence of humans. When it comes to education, a COBOT would be a robot co-educator which works alongside human teachers in the classroom to help them conduct teaching related activities (Timms, 2016). There are many avenues in research and practice which AI could be utilized in the education field, ultimately it would be to try and transform how we manage tasks like dealing with timetabling, admissions, attendance and predicting students at risk among other things. In the intelligence age there is an abundance of educational resources available, more flexible modes of education and the onset of more accessible AI functionality, as a result it is predicted huge changes will take place in the education space (Wang et al., 2018). However, the closest AI has reached in the educational sphere thus far has been focused on for the most part in solving problems by creating systems which are as effective as human one-on-one tutoring (VanLehn as cited in Roll & Wylie, 2016). Whereas now as AI is evolving much more quickly due to a larger research focus and platforms like IBM Cloud and Microsoft Azure offering AI services, especially in the areas of machine learning and as a result supervised, unsupervised and reinforcement learning. As experts in this industry, we feel that while the automation of administrative tasks will be where we see the biggest impacts for the foreseeable future in education, there are at least three other areas which we are seeing and will bring a larger impact. We will present in the following sections details of those three elements where we are currently working, have achieved success and then provide future insights into education and AI mixing together.

Opportunity 1: The Rise of Robot Educators

Robots are encompassing many parts of our professional society, and especially for some time now in manufacturing factories for building cars but now we are seeing them pop up in other industries you may not expect such as health care and agriculture. In this part of the chapter, we are going to present the current status of the use of robotics in the education sector, where it is headed and proposing how it best could be transformed to align learners and educators' objectives and needs.

AI has been on a steady burn as it works its way into most industries in the modern workforce from the automation of repetitive tasks to the intelligence it can gain from the analysis of big data. Education is one industry that is of particular concern when it comes to the integration of AI, while yes it may bring some good benefits in terms of reducing the amount of administration that is required of educators and finding out insights about students who may be at risk (as will be discussed later), it also brings along

with that some concerns for educators. One of these concerns is something that is on the horizon, that of educational robots.

In the modern era, the use of multi-media tools in education has become increasingly popular and mainstream at this point in many first world educational institutions. What has pushed this further has been the recent COVID-19 virus that has affected most industries including education and has forced students and educators to work and study remotely. However, with relation to the introduction and use of robots in the education sector, they are being used more in schools and with children, they are especially getting a head start on the use of robotics through toys becoming much more advanced and 'interacted with' during playtime (Beran, Ramirez-Serrano, Kuzyk, Fior, & Nugent, 2011).

Surprisingly, there is a lot of research conducted on this topic, however despite this scientific evidence, there is a lot of strong skepticism about the use of robots in the field of education (Conti, Di Nuovo, Buono, & Di Nuovo, 2017). This doubt and skepticism which arises comes with most topics related to AI because of its negative connotations regarding its replacement of humans, the education field is no different with these concerns. The more educators hear about this idea or integrating robots in the education sector, you will likely hear more negative than positive comments, which may come out of this fear of losing their job due to being replaced, lack of understanding or the lack of trust that robots can match their efforts in the classroom.

When it comes to transforming education so that robots can teach students, several factors in the research come into the limelight as to whether we can conclude in this chapter if the idea is sound or not. These really come down to, what are students' attitude towards a robot teaching them versus a human? Then can a robot be as good and as safe as a human educator? And what are the ramifications if robot educators were to replace human educators? We will explore these dimensions below.

To begin with let's explore students attitude and feeling towards robot educators and refer to some critical research (Fernández-Llamas, Conde, Rodríguez-Lera, Rodríguez-Sedano, & García, 2018), where an experiment was conducted in which a robot and a human educator were used for teaching a computing related subject to a group of K-12 students (6-16 years of age). There were 210 students who had a robot as the educator and 96 had a human educator. They were not focused on the scores obtained in the performance of students after teaching occurred but looked at the student's attitude towards robots across the board. They discovered among several other factors, that age is a large contributor when it comes to how students feel in terms of their attitude towards robot educators. An interesting result which was discovered when they asked students the question "I feel that if I depend on robots too much, something bad might happen", younger students thought that it is unlikely to happen, while older students have much more concern about this (Fernández-Llamas et al., 2018). Adding to this, researchers discovered the way in which robots moved, how strong they are or what they do when you interact with them, seems to worry younger students more than older students. The researchers explained this is likely because younger students would likely have less experience than older students, but this is a conflicting opinion and will likely change, as previously discussed more children's toys are making use of this technology. Another interesting study which showed a positive acceptance of robots in education and the care of children was Conti et al. (2017), these researchers showed the results of their study where a group of 25 practitioners, specialized in developmental disabilities, and 55 students in psychology and education disciplines. Their results which were quite interesting (and in some ways expected) showed that all participants demonstrated a global positive attitude towards the use of a robot in this educational environment. However, the practitioners had skepticism and doubt, while students showed an overall positive perception and significantly higher willingness to use the robot.

When we look at the skill, safety and acceptance of robot educators versus human educators there are varying views in the research on this topic, where there are many positive research studies that focus on if they can help students learn skills and work well in teams, equally there is negative research which highlights elements like students being scared of robots. A couple of studies completed by (Barak & Zadok, 2009) and (Varney, Janoudi, Aslam, & Graham, 2012) showed that when robots were introduced as an education tool, they could in fact increase the learning of '21st century' skills and increase students interest in robotics. The study which Barak (2009) conducted showed that with high school students, they were successful in coming up with innovative solutions to problems when using robotic kits such LEGO Mindstorm and increased the likelihood of small teams working together successfully. This was compounded by Varney et al. (2012) which highlighted that robotics was a highly effective tool in developing team skills in students. Further to this, the research showed the use of robots within various educational tasks with young children, actually supported constructivism as a learning method. In particular, students focus on discussing, solving problems, working with other students and combining knowledge in order to construct their robots. Which are all positive elements that highlight the useful of robots in the classroom.

On the flip side to this, Park et al. (2011) completed a study with human versus robot educators and positive/negative/neutral feedback styles with 6 conditions, that was conducted to determine the effect of a robot educator in the classroom and the educators feedback on students attraction and acceptance towards feedback received. Interestingly, they showed that feedback when given from a human educator was more accepted by students versus a robot educator. Furthermore, students in a robot-led classroom showed greater attraction towards the educator, only when they received positive feedback. So, it really showed that students are willing to accept negative and positive feedback from human educators when required, but when it came to robot educators, they were not happy to receive the negative feedback, only the positive, which may impact learning. When it comes to students perceptions of robots in the classroom, Woods (2006) conducted a study with 159 children and asked them to evaluate 40 images of robots through questionnaires with the focus on investigating how children perceived robots appearances. Their results showed that children perceive robots' intentions and capabilities purely on what they see of the robot's appearance. In fact, children judged human-like robots as aggressive and machine-like ones friendly. So, where robots in the classroom may be venturing towards looking more human-like, could be a negative aspect and affect students learning, versus having a machine-like robot which surprisingly seems like it may be more accepted.

When it comes to the ramifications of robots replacing human educators some might say it is inevitable that we are going to get to the point of having robots in some shape, form or another in the classroom, whether it is directly educating the students in primary or high school or even lecturing in a University setting, or it may be just as a support role (COBOTS for example) helping educators achieve their goals and not be weighed down by repetitive administrative tasks. We need to consider this could be a reality in the very near future but we are not there yet, as exhibited in the following study (Oshima, Oshima, & Miyake, 2012), the authors focused on developing learning environments where robots would play a critical role in supporting service educator's active engagement in collaborative learning. They employed a COBOT named 'Robovie-W' (a communication robot, was developed at ATR, Japan) as a learning partner in a reading comprehension activity. Within this activity students were placed in groups where they would collaboratively read and construct their understanding of different topics from an article and then explain it to the other groups. Each group was formed with students, one of these communication robots and the educator supervised (the students and the COBOT). Robovie-W oversaw explaining the

article and the students reported on how the ideas from the articles were related to one another. Their results showed that there was no significant difference in the learning among all the groups through using the COBOT, and in fact they learned in the same way as they had from collaborating with a human educator and peers. It revealed that the effectiveness of COBOTS is influenced by the human's expertise in collaboration (a strong focus should be on what tasks and duties the COBOT should be used for within the classroom).

Some of the main concerns which are associated with robot educators replacing human educators are focused on privacy; attachment, deception and loss of human contact; control and accountability (Sharkey, 2016). All of which have their own effects on students in the classroom, and as you would expect negative in nature for the most part. The following study (Sharkey, 2016) argues that classroom robots are likely to impact student's privacy, especially when they are used for tasks such as measuring a children's response to questions/tasks or when digital records/video are kept of interactions. They go on to say that one other downside of these educational type robots over humans are they are designed to try and be social, and often is achieved through deception, in order to show they understand and care for students. Which can lead to problems with trust and reduced human contact or on the other side of the coin, students could form attachments to robot educators that could have toxic effects on students personal social development in their life (Sharkey, 2016). The last key points the researchers highlight is that we should be worried about robot educators over human educators and their ability to make decisions about children's behavior in the classroom effectively without having a negative impact on the student's mental health and their educational experience.

To conclude this section of the chapter, let's look through the looking glass at a possible scenario in the future and the impact that it will have on the education industry. This scenario will be where a robot is lecturing to students and delivering practical sessions in a University setting. At the current point in time what we call lecturers are a type of educator who has completed a PhD in a specific field and would teach and research in that specialization. Through completing a PhD this educator becomes a specialist in that field, and through on-going research, they develop lectures and practical sessions for students to develop their skills and help them to learn more about the topic. Knowing how to design and present content for a lecture that allows for maximum knowledge absorption and engagement by students as well as determining how to devise tasks so students can learn hands on skills is important and takes years of skill development and trial and error.

In a scenario where a robot takes over this role, would possibly lead to a loss or change in employment for this kind of educator, of course, depending on the skill of the robot. As it is unlikely, we will reach singularity in the near future and human capabilities such as creativity, empathy and understanding will not emerge in robots for decades to come (Heersmink, van den Hoven, & Timmermans, 2014), which the author may be inferring that robots will unlikely be able to have the same intelligence as humans and thus not be creative enough to teach a class effectively. The focus of this robot and lecturer collaborative relationship will lead to lecturers focused on writing the content and tasks as well as scripts for a robot to deliver (as well as a likely list of frequently asked questions and answers or directly connect to various online databases to try and find the answer). This scenario would not be ideal for educators, but it will be beneficial in some ways for the educator as they will not need to spend countless hours repeating the same class (which is often the case, where lecturers repeat the same practical class to different cohorts of students). However, they may lose a sense of value as a professional, as the result of being someone who just generates content and the robot is the one who delivers it (or 'teaches') to students.

For students, it will likely be problematic as they will not get the same human to human interaction they have in the classroom and likely be more of a monotone knowledge delivery mechanism without such things as banter or deep dive analysis and conversation. As previously shown, students have mixed reactions with robots especially related to receiving feedback on tasks, however they do bring a lot of positives especially with relation to skill acquisition and teamwork. What we really must ask is that can robots when armed with the right content (produced by a PhD expert (whom teaches knowledge from past, present and their own personal research) and possibly integration of a teaching methodology or approach) transform the educational experience in order to teach a class (or multiple classes) to students and ensure learning outcomes are met; students are engaged; be able to have constructive conversations and ensure feedback is well-received by students. Until this is achieved, the short answer is no. The upside from robots would be when they reach this level, they could be teaching multiple subject areas as opposed to typically a PhD expert is confined to a very narrow discipline. Furthermore, they will be able to teach all day, every day without breaks. Where human educators become no longer relevant will be when robots bypass just general pattern recognition and are able to think and process information like humans, which is still a work in progress.

Opportunity 2: Analyzing Student Skills and Allocating Tasks Intelligently

In universities, there has been an increasing emphasis on Project-based Learning (PBL) or Work Integrated Learning (WIL) (Patrick, Peach, & Pocknee, 2008) and transforming the student experience to get more 'real world experience'. Recognizing that there is a gap between students' skills and industry's expectations, these frameworks aim to help make students work ready and get a sense of what it takes to succeed in the industry. In the fields of Information Technology and Engineering, students typically undertake industry-oriented work towards the end of their degrees to demonstrate their learned knowledge and skills. They have already had two to three years' worth of training in technical aspects, however, they have not had the opportunity to work with clients and large project teams to develop the requisite teamwork and soft skills. Arguably, this is the most important aspect of a student's experience, ensuring they are work-ready on completing their degrees and how to transform the education sector to do that intelligently is the focus of this part of the chapter.

A wide range of project-based work at universities can be considered within the umbrella of PBL or WIL. Depending on specific details, different programs have been developed, such as Capstone (Dutson, Todd, Magleby, & Sorensen, 1997; Hauhart & Grahe, 2015), Industry Experience (IE) (Hagan, Tucker, & Ceddia, 1999; Lamancusa, Soyster, & George, 1997) or Industry based learning (IBL) (Holt, Mackay, & Smith, 2004; Thiruvady, Morgan, & Bedingfield, 2020) programs. Despite their differences, all these programs have common aspects which could be transformed using AI, such as allocation problems associated with students and projects/clients and supervisors and projects.

There are several challenges associated with efficiently running the capstone (final year projects), IBL or IE programs. In the initial stages of a project, the main problem is one of allocating students to projects and supervisors to projects. There are several aspects that need to be considered during this allocation phase. On the student's side, a project needs to be found, which matches their degree's major, skills and preferences. On the other hand, projects are unique, with varying requirements and may have the need for students who do not have the skills or who are not willing to join the project. Hence, finding an ideal matching of students and projects that satisfies all parties is a very complex problem, even

for AI to work with and solve. In similar fashion (and a slightly less complex problem), is identifying supervisors for projects is not straightforward and brings a set of unique challenges.

During the project itself, the major challenges are around communication, coordination, and day-to-day running of the project. Learning management systems, such as D2L (Corporation, 2020) and OnTrack (Cain, 2020), and integrated systems, such as Microsoft Teams, go part of the way to alleviate some of these issues. They provide a portal/repository to organize project materials, conduct assessment, manage communication (e.g. online chats, meetings) and storing and maintaining project outcomes. Nonetheless, in order to transform this problem into a workable solution will require much greater integration and the use of AI integration will be paramount to getting it to work effectively and efficiently in the future.

The problems mentioned above can be classified under these specific elements below, where we will explain each one in detail:

1. **Allocation of students to projects/clients/companies:** the context of this problem depends on the type of project and whether a student is at a client location or not. There can be common aspects in each of these allocation problems (e.g. matching student skills), but there may also be substantial differences (e.g. client/company preferring a certain student). In the case of an industry placement, typically, clients will prefer certain students (obtained by interviewing them), students will have preferred companies, skills may need to be matched and other potential restrictions. In capstone projects, the focus is on the team, which is being built from experienced and inexperienced students (and often manually). For example, client preferences may not be considered.
2. **Allocating supervisors to projects:** each project typically needs an academic supervisor. The academic supervisor is responsible for mentoring, and among other things, ensures that the project runs smoothly. Moreover, they are responsible for the academic outcomes. That is, they ensure that the students are assessed according to a pre-defined assessment framework, which captures whether the students have successfully completed the project. The problem of allocating appropriate supervisors (i.e. academic staff with appropriate technical experience related to the project) is a non-trivial problem and one that needs a very good solution.
3. **Scheduling staff-client visits:** in some cases, industry-based programs require students to undertake their projects at the client sites. An academic member of staff will be linked to each student's project to ensure that the academic aspects are followed accurately (e.g. assessment). Hence, the staff member must conduct site visits (at least twice) to gauge a student's progress. From the academic perspective, there is a short window (e.g. two weeks in the middle of a semester) when all visits will take place. Furthermore, depending on time commitments, a staff member may supervise multiple projects. Thus, the problem of scheduling site visits (objectives of minimizing "wasted" time) is important and ripe for the use of AI integration to transform it.
4. **Scheduling student-supervisor meetings:** while it can be expected that students and supervisors organize their own meetings (typically one hour and weekly), it is often the case that a reasonable time cannot be easily found which meets both educator and student schedules, especially when resources among teams must be shared. Hence, a procedure to transform and automate this scheduling would be highly sought after.

To conclude this section, the ever-increasing student numbers in these programs and growing AI opportunities, the scalability of the industry-based programs needs closer attention. For example, the allocation problems can still be manageable when numbers are small (i.e. student and client numbers).

Re-allocating a few supervisors or students can be manually handled by the management staff. However, when dealing with large numbers (several hundred compared to under one hundred), the number of potential changes and associated combinations can cause disruptions that can take weeks to resolve. Hence, automation with the assistance of artificial intelligence is unavoidable to transform these programs and make them feasible for the education sector.

Opportunity 3: Transforming Student Data to Create Intelligent Predictions

When it comes to figuring out how students are tracking through their degree or even in a single subject it is a particularly challenging problem for most human educators and even current learning management systems. However, being able to utilize new advances in AI can help educators to be able to transform data into useful insights and predictions. In this section of the chapter we will explore how we as educational institutions across the world now, with advances in technologies, have access to large amounts of student data that can now be used to make predictions on student performance. This data can include students' grades, activity usage, online discussions and historical access patterns. The question is how we can transform student data to make intelligent predictions in order to help them complete their studies and avoid risk of exclusion from their educational institution.

Attempts to augment the value of student data and applying appropriate Machine Learning (ML) techniques are intended to assist educational institutions, teaching staff and those involved in student administration and support. There are numerous issues and problems institutions are hoping these ML and AI advances can assist in teaching and support decisions. Issues around student behavior and understanding the influence their backgrounds on whether they are at risk or will drop-out have been explored by Kovacic (2012) in the context of studying online and Azcona, Hsiao, and Smeaton (2019) with the intention of working on empowering students. There is also a commonality with education providers on providing a quality education and implementing changes where necessary to reduce the inclination for students to withdraw (Yadav, Bharadwaj, & Pal, 2012) and to better understand these cohorts and their reasoning (Kerstin, Johannes, Simon, & Julian, 2018). Retention is a multi-faceted concern for students as presented by Rodríguez-Muñiz, Bernardo, Esteban, and Díaz (2019) that can involve their past and present educational opportunities in classes, social environment and background, and personal (and parental) income capacity. These problems involve determining applicable rules for different student cohorts, degrees, pathways, linked variables and providing efficient solutions or answers to the institution. As Rodríguez-Muñiz et al. (2019) reported, there are only suitable baselines available rather than a more rigorous ML approach. This problem requires examining lecture attendance, study mode, specifically full-time or part-time, the age of part-time students, prior studies or education pathways and the reasoning behind choice of institution. Retention issues also apply to MOOC (Massive Open Online Course) environments specifically due to the use, and impact of technology and online learning environments, and student performance. Hughes and Dobbins (2015) described the need for monitoring to understand presence and engagement to assist in capturing, analyzing and understanding the usage data from MOOC's. Further work is required to adequately categorize students, include applicable metrics and provide suitable feedback.

To transform the education sector and to develop potential AI solutions to assist with academic performance requires suitable datasets for training (Adejo & Connolly, 2018) and potentially cross-checking or combining sets as necessary, for example, interactions in the online system and prior performance (Akçapınar, Altun, & Aşkar, 2019). Academic performance judgements on final marks using data from

discussion forums has been explored, such as Romero, López, Luna, and Ventura (2013). Problems arise in finding a single solution given the differences in subject areas and learning content that have some incompatibility with current data mining techniques. When there are multiple assessments or evaluations during a teaching period, Kaur and Kaur (2015) have acknowledged performance improvements. While Jokhan, Sharma, and Singh (2019) have argued that problems with progression in a blended course require an early warning system for interventions utilizing logins, data on activity completion and engagement with resources and learners. Being unable to predict marks and determine appropriate support opportunities is a common struggle for teachers in higher education (Kotsiantis, 2012).

Further problem areas exist when examining enrolment behavior that impact on institutions (Herzog, 2006). To help students, intelligence and understanding on retention, transfers, course completions and devising programs and interventions to mitigate retention and completions are needed. Hoffait and Schyns (2017) has specifically identified issues in first year with the change of education environment, financial pressures and incorrect course selection with no skills mapping evident. Moreover, Kardan, Sadeghi, Ghidary, and Sani (2013) identified concerns with courses (subjects) not offered and the limited choices in some teaching periods. For institutions, accurately determining student demand and managing overheads to maximize options and make efficiency decisions alongside appropriate scheduling to help limit any overlapping also requires a suitable resolution.

The challenges faced by students and their respective institutions both require attention for better support; the student who may require clarity on choices, an intervention or further study support and the education providers needing to balance student progression, flow and success against having demonstrated appropriate learning and graduate outcomes. Attempts at solutions using AI and as a subset ML are presented in the proceeding section that demonstrates the potential such advances can provide in transforming the education experience.

SOLUTIONS AND RECOMMENDATIONS

The Solution to the Rise of Robot Educators

Singularity, which is if you don't know, is a point in time when AI reaches such sophistication that computers and thus robots will reach a level of intelligence that matches or exceeds that of all humans. It is of the authors view that it is unlikely this level of AI will be reached within the next 30 years due to the fact that we as humans still do not fully understand the functions of the human brain, and to strengthen this argument, if you ask Dr. Koch who is the Chief Scientist and President of the Allen Institute for Brain Science on how close we are to understanding the human brain, he responds that *"we don't even understand the brain of a worm"* (Balgrosky, 2019). Clearly, as a result of being so distant from understanding how the human brain works, it will be difficult to replicate what we don't know in a robot. This venture is not something that will be particularly valuable for humanity, especially educators, as it will transform the workforce and render in many spaces, humans to become obsolete or rendered to jobs which are outside of their expertise.

Where we as authors and thought leaders see the transformation of education occurring with regards to robots is (and the most rewarding direction) rather than replacing humans, and thus human educators, we should embrace the solution of what is termed multiplicity where robots and humans will work together and transform the sector that way. There can be several fascinating and useful combinations

where humans and robots contributing towards specific goals in the education industry can bring forth many positive and constructive outcomes. In essence, where this will head towards is complimenting each other, where humans can be creative and innovative without the burden of administrative and/or repetitive tasks. As where robots can take over these kinds of tasks which tend to take away from innovation or creativity on the human side. This is where the focus should be, for a future which will transform and bring the education sector to a new and exciting level for the teachers and students alike.

Intelligently Analyzing Student Skills and Allocating Tasks

As previously discussed, there are several problems that may occur when organizing students in teams for industry-based programs. As a reminder, they are the following: (1) allocation students to projects/clients/companies; (2) allocating supervisors to projects; (3) scheduling staff-client visits and (4) scheduling student-supervisor meetings.

In order transform these problems into solutions for the education sector, the use of mathematical modelling techniques (Nemhauser & Wolsey, 1999) and/or AI based approaches (Blum & Roli, 2003; Marriott & Stuckey, 1998) have previously proven extremely useful. In the field of operations research (OR), these problems have been studies and are known to be complex. These problems can be stated in a straightforward manner but finding a solution or finding ones that optimize an objective can be extremely hard. In this respect, there has been a substantial (research) effort to develop methods that can deal with these problems efficiently. Some of the most promising approaches have been developed by the AI (e.g. constraint programming or metaheuristics) community, where the aim has been to find good solutions in reasonable timeframes.

The concept of industry-based projects has been widely adopted in university programs. However, there is no uniform structure to the way in which these projects are conducted (although there is a move to standardize this across the industry). Hence, generic software incorporating AI, ML or OR techniques are very hard to design, and the vast majority of the problems require highly customized software to find reasonable solutions. Nonetheless, for a small subset of the problems (or at least for some problems with small numbers), there is off-the-shelf software that can provide solutions which are acceptable to a certain degree but not completely.

Whatever the case, any software solution is likely to provide large gains over manually solving any of the above problems. For example, consider a semester where 600 students are required to undertake a capstone project. A good allocation of the students, at a minimum, requires surveying the students for their preferences, matching their skills, considering their availability and satisfying demands of the team. Other considerations such as gender equity may also be important. If a solution is to be found via manual means, it could take weeks to find a feasible solution (not even one that is optimized in any sense). Hence, investing in software that can provide good solutions (which may need "tweaking") within minutes, is of considerable value and could transform the experience for educators running these capstone programs. Thiruvady (2020) consider the IBL program consisting of about 100-150 students. They consider similar goals and restrictions and show that metaheuristics and mathematical modeling are vastly superior in several aspects compared to building solutions by hand.

A more complex problem is that of scheduling staff-client meetings. There are a number of complex factors to consider including supervisor/client availabilities; travel times to the client site and staff skills that match the client's business, etc. Determining a reasonable schedule for a large number of staff members (e.g. 30 members of staff overseeing 150 student placements) using manual means is not feasible.

Intelligent software can be developed that considers travel times (using Google maps for instance), availabilities of staff and clients, waiting times, matching skills and so on. Note that it is possible that a solution may not exist with the large number of restrictions imposed, for example, the availability of a staff member and client may never match. However, the software will at the very least be able to transform the experience by pinpointing the conflict and person in charge of the scheduling can approach the educational staff members or clients and request that they provide additional availabilities. In a manual setting, may take several days just to realize that such a conflict exists.

In conclusion, we have discussed some of the problems that arise in industry-based programs in the education sector and emphasize that the process of solving the problems using AI is imperative. The main point of focus is efficient allocation since these are the type of problems that most commonly appear in this domain. AI provides tremendous potential in alleviating the issues associated with manual work and can expected to be a point of focus in the future for transforming the education sector with regards to student final year industry projects.

Making Intelligent Predictions When It Comes to Student Data

Many attempts at using and incorporating AI into transforming and achieving educational outcomes for students, assist support and business decisions by institutions are evident in the hope such AI infused solutions provide answers in a quick, efficient and reliable manner.

To help gain insight and devise solutions, the focus on analysis of data from institution LMSs' is a common target. Kovacic (2012) was able to take this data and generate and evaluate models on enrolment data capable of predicting student outcome. Using an array of data requires suitable mining and cleaning so the results can be easily understood and relied upon. There is a trade-off in the testing accuracy of models with those more efficient and accurate including additional variables that requires additional processing. Successful implementation occurring before enrolment can better support institutions in knowing student retention risks thus allowing support services to be engaged. Exploration with suitable multiple data sources, including historic information formed part of a solution devised by Azcona et al. (2019). The building and training of predictive models using demographic and student activity data allowed for feedback to be provided to students. As this was being generated and adapted from multiple sources, tests were able to determine the suitability of the K-Neighbors classifier. Other predictive models (Yadav et al., 2012) have been created, tested and implemented to generate lists using numerous variables for institutions to aid the support team in working with students prior to discontinuing. Using this intelligence, ML has been incorporated into Early Detection Systems (EDS) such as from Kerstin et al. (2018) using performance and demographic data to help identify dropouts. More accurate results require greater data and a prediction model to help train the data which is a common challenge in developing such solutions. By using AdaBoost, also supported by Kaur and Kaur (2015), Kerstin et al. (2018) found early interventions were possible that helped manage education institution costs in preventing dropouts or speeding up the decision for the student, though the preference is to determine appropriate student support. Questionnaires coupled with the institution or university administration system using social, demographic and academic details are also being adopted to help identify course dropouts rather than course transfers, a more difficult problem to identify. Dropout themes were identified applicable to the whole institution by Rodríguez-Muñiz et al. (2019) that included vocational training, graduates from other degrees, exams from mature age students, student age, inadequate teaching methods, or time commitment all influence the probability of students not continuing.

Investigating student behavior has revealed higher marks are awarded to those with greater engagement and interaction with fellow learners and subject content. Hughes and Dobbins (2015) developed a dashboard reliant on a predictive system using statistics from a MOOC that required access to student interaction data and engagement with related blog posts and social media, alongside attendance and assessment results. As a MOOC requires online engagement with content instead of being physically present introduces new challenges. Notably greater attendance during revision sessions did not equate to higher exam performance nor any real link between attendance and assessment more broadly. By creating and allowing this system to self-evaluate over time has helped improve its effectiveness and students attempts at rectifying their academic performance. The use of visual notifications was chosen to help subvert declining student engagement and marks.

To help improve student academic strength, classification techniques have been explored to ultimately improve retention. Adejo and Connolly (2018) adopted surveys and questionnaires to capture demographics and student records, LMS data for student interactions and refined their processes by working through classification techniques to reduce errors and developing new policies. In comparison, Akçapınar et al. (2019) also used data from the online learning environment to form a suitable algorithm (kNN) while Kotsiantis (2012) utilized existing regression techniques to predict marks in a prototype support tool. Creating an alert tool using statistical modelling from the LMS considering online behavior and performance is another solution proposed by Jokhan et al. (2019). This tool can measure progression, using an AI algorithm of past and current performance could identify underperforming students and consequently be capable of offering interventions. Jokhan et al. (2019) identified behavioral changes with students accessing the online learning environment more often and completing activities. Therefore, it can be argued it was able to successfully assist with the motivation and engagement of students, provide personalized activities and instructions where necessary, relevant academic advice and applicable support services. One aspect, discussion forums was the focus on being incorporated for classification algorithms to help determine student results for their final performance (pass/fail unit/course). Romero-Zaldivar, Pardo, Burgos, Kloos, and Education (2012) decided to collect data in the middle and end of the teaching period. This provided opportunities for personalized help to try and avoid failure. The data specifically collected in the middle was able to be used as early prediction for instructor actions or interventions.

A challenge with using AI to help classify students so appropriate measures can be implemented is with choosing which data sources to incorporate. Herzog (2006) worked on prediction models with the intention on a broader investigation on enrolment outcomes and completion times as a solid evaluation base. A data mining approach involving the institution student database, parent income data and students who transferred out yielded the most accurate results. These models provide institutions confidence in resource allocation, potentially higher graduation rates, reducing student costs and financial pressure, and the ability to offer appropriate support, such as counselling, at right time. Institutions are then able to recoup some costs, deliver more accurate enrolment predictions, projections and campus planning or capital works projects. Similarly, Kardan et al. (2013) trained neural networks to help understand and predict the impact course selection has on satisfaction. Challenges were present when relying on student responses in a questionnaire given the opportunity to provide dishonest answers that could end up being difficult to validate and the potential of the system learning from incorrect data. Hoffait and Schyns (2017), however, aimed to detect students from the beginning so assistance could be provided prior to classes commencing and if necessary, work through any reorientation. The solution from Hoffait and Schyns (2017) was devised across many degrees with the focus first year failure that could be extended to new contexts. Data mining techniques were employed on background checks to determine the most

vulnerable students with separate algorithms, compatible with the random forest approach, designed to assist in determining success and failure in classes. Multiple data mining models helped ensure the reliability of predicting student failure.

AI can transform the education sector in order to assist students, teaching and support staff and institutions overall in modelling and understanding student behavior for course success and completion with automated measures to proactively engage with those showing reduced performance. Progress checkers and proactive advice based off current progress with assessment, results and evidence of interaction with unit content and resources are all being explored, and solutions devised to help support staff and institutions. Challenges are evident in determining accurate performance patterns and therefore being able to provide some automation of support services alerting students or divisions within universities to reach-out to those impacted. Determining retention risks and applying preventative strategies is necessary to provide warnings and opportunities for teaching staff to engage with these students. Ideally automation in providing lists of students experiencing difficulties to be targeted for additional support including flagging and alerting students to support avenues, or mechanisms they are strongly encouraged to take advantage of to help manage their studies. Improved understanding of student strength and capacity based upon prior studies by collecting and collating of relevant student past progress provides a partial solution when used as part of the investigation in working through any study support with students in the subject. Work in utilizing the data in AI solutions allows educators the opportunity to identify students with learning or study difficulties that may be indicative of a larger problem requiring interventions in generating reports requiring action by the teaching team. AI can also assist in building profiles and understanding of students and assist in categorizing the cohort appropriately to help facilitate support and to drive decision-making from the institution level. There is much to achieve in incorporating AI technology in education with solutions still requiring much testing and evaluation given the breadth of potential models, classifiers and algorithms.

FUTURE RESEARCH DIRECTIONS

The three problems and solutions presented in this chapter demonstrate that there are several ways educational institutions can embrace AI and transform the experience for educators and students at an enterprise level. Further work is required to explore the long-term implications of these solutions and ways of conducting education, for instance robots and humans working together; allowing AI to perform complex administrative tasks around student project teams and making judgement calls on the student journey when it comes to analyzing their data. The ever-changing technology environment and the movement towards transforming sectors like education with AI tools and techniques suggests that more research, understanding and awareness is required in order to make the right decisions that will impact the lives of humans across the educational lifecycle.

CONCLUSION

AI is becoming an important and emerging field of research and practice as well as quickly integrating itself in many different industries such as finance, retail, manufacturing, farming and now a growing presence in education. In this chapter we focused on looking at how AI can transform the education

sector by looking at three current problems where we as leading educators are encountering. These three problems were (1) the clash between robot educators and human educators (2) how can AI assist with student skills and team allocation in industry based work subjects and (3) how can AI be used with educational data to better understand students and make predictions about their progress. We presented where the current research lies, what our work has encompassed and provided future thoughts as leaders in the education sector. What we discovered was that there was there was a lot of controversy surrounding robot educators with some distinct options forward to incorporate them into the education sector without too much disruption. We presented our research regarding how organizing teams of students for final year industry-based project subjects had many moving parts and is an extremely difficult venture when conducted by human educators alone and one which AI could assist greatly in transforming these operations and managing the constraints more easily. Then lastly, we explored the element of collating student data and using ML models to make predictions about the students' journey which can assist greatly in helping them to avoid exclusion from their studies and increase their chance of success. AI and all its emerging benefits and challenges are going to become part of the education sector to a greater extent now and in the future, until we understand it properly and then embrace its benefits, we will not be able to utilize it effectively to transform the role of educator and student in the future.

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Chapter 3
Digital Transformation and Strategic Management of Frontline Services With Robotic Technologies

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ABSTRACT

Robots and artificial intelligence have been touted as vehicles for generating operational efficiency and cost savings for a business enterprise. Specifically, automated, digitalized frontline services have the potential to streamline an enterprise's service efficiency, alleviate burdens from its human employees, and enhances its relationships with the customers. Besides these cost and functional benefits, this chapter posits that robotic services can garner customers' preferences and satisfaction, that is, there are situations in which robotic services are not only a cost-saving option, but they are even preferred by an enterprise's customers. Specifically, two important drivers—social distancing and utilitarian expectations of services—can lead to customers' choosing robots over humans. This chapter concludes that deploying and managing digital and automation technologies, such as service robots, in frontline services can not only transform an enterprise's operations but also enhance its customer management and service expectations.

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INTRODUCTION

Digital platforms have transformed how an enterprise provides its products and services to its customers, who in turn, engage with the enterprise by interacting with its platforms before, during, or after their purchases. Some of these technological transformations include social media and online review systems (e.g., Dong et al., 2019; Kim et al., 2016), mobile technologies (e.g., Wang, 2020; Kaplan & Haenlein, 2019; Wang et al., 2018; Wang et al., 2016; Kim et al., 2015; Wang et al., 2015), digital advertising (e.g., Humphreys et al., 2020; Ghose & Yang, 2009), and sharing economies (e.g., Cheng, 2016; Matzler, et al., 2015), to name a few. These types of technologies have become prevalent in today's digital landscape. Managing relationships between an enterprise and its customers has fundamentally changed, from traditional, human-to-human contacts, to digital, human-to-machine interactions. No longer is human presence a requirement, as these types of interactive technologies provide enterprises with the capabilities of managing their customer relationships digitally or virtually. That is, when a customer uses these digital platforms, an enterprise can provide the requested services and information without any physical contact between its employees and the customer.

In recent years, however, digital technologies have started to go beyond just the virtual arena. Combining both digital and mechanical capabilities through technological innovations and algorithmic programming, technologies driven by artificial intelligence (A.I.) and robotics are capable of smart, physical, and real-time interactions. In particular, frontline services have become a testing ground for A.I. and robotic technologies. For instance, in the hospitality industry, both A.I. and mechanical capabilities are necessary to deliver room services. Thus, forward-looking hotels are beginning to integrate robots as part of their enterprise operations (Ivanov, Webster, and Berezina 2017). A.I. and robotics are increasingly present in areas such as "home, health care, hotels, and restaurants," and "social robots such as Pepper are used to replace human greeters to welcome customers in customer-facing services" (Rust and Huang 2018). However, despite the increasing prevalence of robotic services, whether and how they are accepted or used by customers remains underexplored. Indeed, most enterprises justify their adoptions of robotic services as a way to minimize operational costs (e.g., Romer et al., 2005; Decker et al., 2017; Wirtz et al., 2018). Given the growing prevalence of interactive technologies and A.I.-driven platforms, enterprises of today's digital age need to understand the contexts under which they can implement A.I. frontline services without compromising their perceived service quality and customers' satisfaction.

Thus, the purpose of this chapter is to explore whether transforming a company into an A.I.-enabled enterprise creates customer-oriented benefits in addition to operational efficiency. Referring to marketing theory related to customer satisfaction, customer-employee reciprocity, digital engagement behavior, and service expectations, as well as social theory on social distancing and social anxiety, this chapter investigates the situations in which customers use or even prefer robotic over human services. Using hospitality as the market context, it presents both original research and the subsequent managerial insights pertaining to customers' service choice and an enterprise's automation management and digital strategies.

The objectives of this chapter are as follows. One, it investigates the situations under which A.I. and robotic services are chosen by customers. Specifically, it provides empirical evidence that shows the important influences of social distancing and customers' utilitarian expectations. Two, it describes how these types of customer-centric, digitally interactive platforms and service robots can facilitate enterprises in a global crisis, such as the COVID-19 pandemic, a topical event at the time of this chapter's publishing. Lastly, it proposes a future outlook on A.I. and robotic services and digital innovations pertaining to marketing and customer relationship management.

BACKGROUND

Artificial Intelligence (A.I.) has been defined as "a system's ability to interpret external data correctly, to learn from such data, and to use those learnings to achieve specific goals and tasks through flexible adaptation." (Haenlein & Kaplan, 2019). In other words, A.I. is a result of a machine's algorithms and learning, which can potentially mimic human intelligence (H.I.), and when it is combined with mechanical functions, A.I. becomes a manifestation of robotics, which can potentially replace physical labor that is traditionally performed by humans. Thus, A.I.-driven robots can be a beneficial addition to numerous economies, including restaurants (Pieska et al., 2013), home security and management (Qiao et al., 2013), housekeeping (Aker et al., 2011), hotels (Kuo et al., 2017), and healthcare facilities (Robinson et al., 2014), to name a few. Because these robots are used predominantly in the service sectors, they are referred to as *service robots* (Kawamura et al., 1996), which are designed and deployed with the intention to provide services and support to customers.

As A.I. technologies evolve and transform businesses, companies, and enterprises, service robots are becoming more and more capable of social interactions in addition to performing their primary tasks and functions. Not only are these robots empowered by software, algorithms, and learning, they are also capable of mechanical functionalities, allowing them to socially interact with customers physically as well as cognitively. Service robots potentially have several advantages over human employees. First and foremost, they are cost efficient. Second, they can augment an enterprise's existing labor infrastructure by helping its human employees with routine, mundane tasks, saving the human employees' hours and effort for more complex tasks. Lastly, customers might prefer service robots in certain situations. For instance, customers are welcomed by a Pepper robot when they enter a financial bank, as the robot helps direct them to the right type of banking services and saves their wait and service time (Schlosser, 2019; Choudhury, 2016; Rust & Huang, 2014). These types of simple yet effective interactions between an enterprise's A.I. and robotic technologies and its customers will continue to be developed, permeating in a variety of businesses and industries in the future (Huang & Rust, 2018). Per the International Federation of Robotics, the success thus far in these developments has led to an increase in the production of service robots (Ivanov et al., 2017). To ensure that robotic services are implemented effectively, an enterprise needs to understand its customers' wants and expectations in the context of A.I. interactions as it decides on their strategic investment and technology deployment.

Given the nascent nature of the field, knowledge on human-robot interactions is limited. Some of the existing findings on human-robot interaction focuses on anthropomorphism. Research suggests that the more anthropomorphic, or human-like, a robot is, the more likely a human is to treat it as if it were a human, intuitively assuming that the robot is capable of accurately interpreting human expressions (Złotowski et al., 2015). As such, humans associate positive feelings, such as delight, toward a robot when its task performance is accurately executed. Likewise, humans can feel disappointment when a robot is unable to process and interpret their human expressions (Klug & Zell, 2013; Tung & Au, 2018). Close associations between humans and a robot also elevate their service expectations. Because customers infer robots' outer appearances and mechanical movements as human-like qualities, they hold robots to high performance standards just as they would with human employees (Nowak & Biocca, 2003). These findings present some promising opportunities for an enterprise. When a frontline service robot is capable of interacting with customers in a seamless and engaged way, they can create a unique "human-robot co-experience" (Tung & Au, 2018) while achieving cost efficiency in human labor. This co-experience can also potentially help an enterprise manage and improve its relationships with its customers. Stronger

customer relationships can then lead to higher customer acquisition and retention and positive word-of-mouth, bringing in new customers or retaining existing ones while increasing customer satisfaction by fulfilling their expectations with the help of robotics and technologies.

However, even though service robots present numerous promising opportunities, whether customers are acceptive to this new form of enterprise-customer interaction remains unclear. While A.I. and service robots have proven to be useful in hospice (e.g., Boissy et al., 2007) and restaurants (Noone & Coulter, 2012), in other situations, customers have resisted them and still choose human employees over robotic or A.I. services. For instance, Longoni et al. (2019) show that in healthcare, customers are more likely to sign up for human providers than automated, A.I.-driven services. Another example is from the hospitality industry. In 2019, the Henn-na Hotel in Japan, one of the first hotels in the world to implement frontline robots, decided to "fire" more than half of their robotic workforce due to negative feedback from both its employees and guests (Hertzfeld, 2019). Given these challenges, this chapter investigates the situations under which frontline service robots are preferred by customers, providing strategies and recommendations for enterprises to decide when and how to implement robotic services. Specifically, this chapter provides evidence that shows the importance of social distancing and customers' utilitarian expectations in services. These constructs pave ways for implementation and deployment of A.I. and robotic technologies, as customers prefer robots over human employees in these situations.

DRIVERS THAT TRANSFORM FRONTLINE SERVICES

Driver 1: Social Distancing

To begin the investigation into under which conditions customers prefer robotic services, this chapter first examines and describes what social distancing is and how it affects customers' interactions with an enterprise. There are two different forms of social distancing, which this chapter coins as *preferred* and *enforced*.

Preferred social distancing is a coping mechanism that people use to manage social anxiety, which can stem from emotional, psychological, and social reasons. Social anxiety is defined as an elevated level of unease or fear due to social scrutiny. Research suggests that socially anxious people elect social distancing by choice to avoid interactions with others (e.g., Alden et al., 1995; Darcy et al., 2005). An essential piece of social anxiety is the avoidance of social situations. Research suggests that socially anxious people independently choose social distancing to avoid interactions with others (e.g., Alden et al.,1995; Darcy et al., 2005). This choice is in part due to their perception of threat that they believe they will experience by interacting with others. Thus, social distancing becomes a personal attempt to avoid any type of situations where interactions can negatively impact one's emotional or psychological wellbeing (Hebl et al., 2008).

Besides emotional and psychological factors, a person may practice social distancing when they perceive a social distance with the other person. A social distance exists between any groups due to their differences in affect, culture, networks, and structural factors, such as demographics, social class, and race (Park, 1924). This type of social distance leads to interpersonal discrimination where people might intentionally keep an increased distance, reduce interaction time, or even change their facial expressions around others (Hebl et al., 2008). In sum, preferred social distancing occurs when people want to avoid a

situation that they perceive to pose a negative impact, regardless whether the perceived situation reflects a justifiable fear or one that is discriminatory.

Regarding choices of services and service consumption, customers who prefer social distancing will most likely choose robots over humans because they perceive human interactions to be threatening. Customers might believe, *a priori*, that interacting with human employees pose emotional or psychological burdens, or after brief encounters, they may perceive a social, cultural, affect, or structural distance between themselves and the human employees. Service robots, on the other hand, do not impose a social distance, as they are fundamentally incomparable to humans with respect to psychology, social norms, and structural factors. As such, service robots pose fewer threats than human employees in social distancing situations.

Enforced social distancing is what every country in the world has practiced due to the COVID-19 pandemic in 2020. In contrast to preferred social distancing, enforced social distancing is mandated by an official entity. The Center for Disease Control (CDC) in the United States defines it as strict "physical distancing" and a means to maintain "space between yourself and other people" (CDC.gov, 2020). Besides the emergence of COVID-19 in 2020, enforced social distancing has been practiced in the past to prevent the spread of other various diseases. For example, social distancing made a significant difference in delaying the effect of the spread of A-H1N1PDM in Mexico in 2009 (Herrera-Valdez et al., 2011). Unlike preferred social distancing, people practice enforced social distancing only to adhere to a blanket policy that forces them to stop interacting with others on an in-person basis.

Under the policy of enforced social distancing, customers will opt for robotic services over human services. Interacting with human employees imposes an actual threat to one's health and physical wellbeing. Service robots, on the other hand, not only help customers adhere to the policy, they are far less likely to impose biological threats, such as diseases and germs. As such, when social distancing is enforced, consumers will prefer service robots.

Summarizing the definitions and rationale of preferred and enforced social distancing, this chapter proposes the following hypotheses:

Hypothesis One: When social distancing is preferred, customers are more likely to choose A.I. and robotic services over human services.

Hypothesis Two: When social distancing is enforced, customers are more likely to choose A.I. and robotic services over human services.

Driver 2: Utilitarian Values in Frontline Services

The second construct that influences customers' service choice is their expectations of values from the consumption experience. When customers purchase and use a service, they have a variety of expectations that they want to satisfy. It is crucial for an enterprise to understand these expectations, as they can play an important role in customers' overall satisfaction. To respond to its customers' needs and wants appropriately, an enterprise needs to adjust its management and tactics on an ongoing basis (Parasuraman et al., 1991). Customer expectations are formed by a variety of factors, including personal needs, situational factors like weather and catastrophe, word of mouth, and service promises made by the enterprise (Zeithaml et al., 1993). As such, different customers have different expectations based on their prior experiences and knowledge of the service. However, even with these preexisting differences, their

overall expectations can still be influenced by an enterprise's strategies such as advertising framing (Hu et al., 2019) or digital transformation of service deliveries.

Broadly speaking, customers may focus on the experiential or the utilitarian benefits of a service. While experiential benefits contribute to a customer's experiences such as enjoyment, fun, social interactions, and emotional worth, utilitarian benefits focus on the efficiency and efficacy of the service's functions (Etemad-Sajadi & Ghachem, 2015). When a service successfully delivers its experiential and utilitarian values that exceed the customers' original expectations, they become satisfied, perhaps even delighted (Oliver et al., 1997).

Earlier literature proposes five dimensions for evaluating customer satisfaction and expectations with frontline services – tangibility, reliability, responsiveness, assurance, and empathy (Parasuraman et al., 1988). Classifying these five dimensions as either utilitarian or experiential, reliability and tangibility would fall under utilitarian values. These functions deliver the basic amenities that satisfy the customers' fundamental expectations from the enterprise providing the service. In contrast, empathy, responsiveness, and assurance, which are defined by employees' caring for and showing professional courtesy toward the customers, would fall under experiential values (Kim & Lee, 2014). Different from utilitarian functions, these interactive, experiential aspects are nice-to-have features that can help elevate a customer's experience and satisfaction, achieving customer delight (Oliver et al., 1997).

In hospitality, customer satisfaction can be impacted by utilitarian functions like room service delivery or check-in assistance, or it can be impacted by experiential interactions like restaurant recommendations and encounters with the staff and employees. As service robots are less equipped to deliver experiential values than human employees, customers focus on different needs and wants and expect different types of values depending on who or what is providing the service. When customers are served by robots, they are satisfied when their utilitarian needs are being met. In contrast, when customers are served by humans, they expect abstract, experiential values, such as social interactions, friendliness, and professionalism, that robots are less capable of delivering. Thus, this chapter posits:

Prediction One: When customers use frontline services provided by a robot, they focus on the services' utilitarian functions.

Prediction Two: When customers use frontline services provided by a human employee, they focus on the services' experiential values.

SERVICE EXPECTATIONS AND CUSTOMER RECIPROCITY

So far, this chapter has examined the two drivers that form customers' preferences for service robots, namely, social distance and utilitarian expectations. The following section continues the exploration of frontline robotic services by looking into their consequences, specifically, the impact of robotic services on reciprocity between customers and the service personnel.

To interact and reciprocate is to be human. Reciprocity is defined as "a behavioral response to perceived kindness and unkindness, where kindness comprises both distributional fairness as well as fairness intentions" (Falk & Fischbacher, 2006, p. 294). In other words, favorable acts are positively reinforced by others.

Reciprocity has always played a strong role between customers and frontline employees. Particularly in the hospitality industry, tipping has become a practice as a means for customers to provide incentives

to reward satisfactory services (Lynn, 2001). Reciprocity practices, such as tipping, affect both the customers and employees in a variety of ways, as tipping impacts the quality of the service provided to the customers, influences and control customers have over the employees and services, ego gratification for the customers, economic efficiency for the frontline employees, and establishments of societal customs and social norms in general (Lynn, 2001).

The present norms of how services are provided and rewarded might be potentially displaced by the digital transformation of the service industries. For example, recent developments like Airbnb are changing the hospitality sector and expanding it, so much so that Airbnb is threatening the revenue generations of traditional hotel chains (Cheng, 2016). This transformation would fundamentally change the way reciprocity between customers and employees is executed. While frontline employees at traditional hotels frequently experience tipping behavior, companies like Airbnb are replace tipping by encouraging intimate interactions between property owners and the customers staying at their accommodations. Instead of tipping employees, customers can directly reward property owners by generating repeat businesses in the forms of future stays, personal recommendations to friends and families, and positive word-of-mouth on social media platforms. In sum, the emergence of digital transformations, automated services, and sharing economies in the hospitality market could potentially transform the existing social norms and reciprocal interactions between customers and an enterprise.

Additionally, reciprocation changes when an interaction shifts from human to human to human to robot. Humans typically reciprocate other humans, who exchange kindness. In human-robot interactions, however, customers are more likely to focus on the utilitarian values of the provided service, which they have already paid for when they made the purchase. As such, customers deem it unnecessary to tip the service robot. This chapter proposes its third and final hypothesis.

Hypothesis Three: Reciprocity diminishes when a customer chooses A.I. and robotic services over human services. A customer is less likely to tip, or they tip less, when the service is being provided by a robot.

The following sections outline the details and the results of two empirical studies that provide evidence supporting the aforementioned hypotheses and predictions.

EMPIRICAL EVIDENCE

Study 1: Experimental Design

The first study is an experiment with 204 participants, whose responses were collected through an online panel company, Prolific. The experiment is a 2-factor, 2-level (2x2) design, using a context involving a hotel stay, during which social distancing is either enforced (i.e., customers are in the midst of a pandemic) or preferred (i.e., customers find social interactions stressful). In other words, the 2x2 experimental design examines the presence or the lack thereof of preferred social distancing and enforced social distancing. In this between-subject study, each participant was randomly assigned to one of the four conditions. The dependent variable of interest is whether the participant would choose a robot or a human employee to deliver a room service request. Figure 1 shows an example of a service robot fulfilling a room service request, which is also used as a stimulus in the experiment. The goal of this experiment is to see how

two forms of social distancing influence participants' preference for robotic services. Upon their service type choice, i.e., robot or human, participants were also asked how much they would tip the service.

Study 1: Analysis and Results

After data collection, the authors specified and estimated a binary logistic regression model, a decision tree classification model, and a linear regression model. See Table 1 for the estimation results of the binary logistic regression model. The analyses provide buttressing evidence for Hypothesis One, that is, customers are more likely to choose robotic services when they are mandated or enforced to practice social distancing ($\hat{\beta} = 1.492$, S.E. $= 0.439$, $p < .001$). Hypothesis Two is also verified, that is, customers are more likely to choose robotic services over human services when they find human interactions stressful and prefer social distancing ($\hat{\beta} = 2.140$, S.E. $= 0.497$, $p < .001$). Combining the findings that support both Hypothesis One and Hypothesis Two, the conclusion this chapter draws is that customers are more likely to choose a robotic service when they are faced with situations that call for social distancing.

As a robustness check, the authors defined and estimated a Classification and Regression Tree (CART). The resulting decision tree is presented in Figure 2. The interpretation of the first leaf of the decision tree suggests that when customers prefer social distancing, they tend to choose robotic services over human services. For the second leaf, when social distancing is enforced or mandated, customers also prefer robotic services.

Testing Hypothesis Three, the authors specified and estimated a linear regression model to investigate the relationship between the dependent variable, tipping amount, i.e., \$0, \$1, \$2, \$3 or more, and the main independent variable of interest, i.e., choosing robotic services. Besides testing Hypothesis Three, the model also controls for demographics such as gender, age, and income level. The resulting coefficient estimates are shown in Table 2, and they provide supporting evidence for Hypothesis three ($\hat{\beta} = -0.754$, S.E. $=0.146$, $p < .001$), showing that customers tip about seventy-five cents less when their services are provided by a robot.

Study 2: Sentimental Analysis With Observational Data

To investigate the relationship between utilitarian expectations and robotic services, the authors examined a data set that comprises online reviews from a forward-looking hotel that incorporates robots as part of its room service delivery. This second study offers empirical evidence using text analysis (Berger et al., 2020; Humphreys and Wang, 2018). It analyzes customer-generated reviews on a hotel in New York City, the Yotel Hotel, from TripAdvisor. Reviews are a useful source of information, as they describe customers' overall perceptions of their service experiences, and Yotel is one of the only hospitality enterprises in the world that implement A.I. and service robots as part of their frontline operations, such as robot-operated baggage checks and deliveries and automated check-ins.

The methodology is as follows. First, the authors used a data scraping tool, Octoparse, to collect the reviews. After scraping more than 1,600 reviews on Yotel, the authors classified the reviews into two sets – robot-focused or human-focused – based on whether a review mentions words and word stems such as *robot* and *automate*. If a review contains these keywords, it is classified as a robot-focused review.

Otherwise, it is classified as a human-focused review, as the customer had not paid attention to the robotic services Yotel provided and instead utilized the more traditional services offered by its human employees.

The authors then calculated the top keywords based on their frequency occurrences, and then they plotted a word cloud for each set of reviews – robot-focused or human-focused – based on their respective top keywords. The goal of this analysis is to understand what customers cared about when they had interacted with robots versus human employees. Additionally, it helps determine what associations and sentiments customers had when they focused on the two types of services, allowing for broader generalizations about consumers' utilitarian or experiential expectations.

Study 2: Analyses and Results

The word clouds are shown in Figure 3 and Figure 4 for robotic-focused reviews and human-focused reviews, respectively. A comparison of the top keywords from each set of reviews, robot- or human-focused, reveals that when customers have taken note of the robotic services during their hotel stays, they are more focused on the logistic process of the service than the experience. The reviews written about the robots comprise words such as *clean*, *location*, *time*, *storage*, *work*, and *luggage*, suggesting an emphasis on the utilitarian functions of a hotel stay. Additionally, words such as *great, good*, *cool*, and *fun*, suggest positive sentiments toward the service robots overall.

On the other hand, the top keywords in the reviews on human services suggest that customers focus more on the interaction with the hotel staff and less about the hotel functions. Words such as *friendly*, *staff*, *people*, *comfortable*, and *service* indicate that when customers interact with human frontline employees, they focus more on the experiential aspects of their hotel stays. Other top keywords include *great*, *nice*, and *loved*, indicating an affective sentiment toward the human employees.

Summarizing the findings from Study 2, this chapter shows supporting evidence for both Prediction One and Prediction Two. Using text analysis (Humphreys & Wang, 2018), this study provides insights and results from a real-world context by examining customers' sentiments toward robotic services in a hospitality setting. It concludes that both types of reviews reveal abundance of positive sentiments. Yet, the robot-focused and human-focused reviews differ on customers' expectations. That is, robot-focused reviews discuss the utilitarian aspects of the hotel stays, while human-focused reviews talk about interactive experiences.

SOLUTIONS AND RECOMMENDATIONS

Given the technology trends in today's digital age, companies and enterprises are likely to wonder whether they should implement A.I. and robots as part of their service offerings. Based on the empirical findings presented in this chapter, it recommends that when social distancing is preferred by customers, robots can help companies and enterprises create unique advantages. Not only do robotic services save an enterprise human resources, in socially distant contexts, customers, in fact, are preferential to robots over humans. Additionally, when social distancing is mandated or enforced by a governmental entity or an official organization, customers would also choose robotic services over human services. In this context, not only can robots maintain safe practices while still delivering satisfactory services, human resources can be diverted to other more complicated or intricate and less physically interactive tasks. On the other hand, companies and enterprises need to understand that the nature of reciprocity might be

changed when robots replace employees for their service deliveries. Findings from this chapter suggest that when customers choose robotic services, they do not reciprocate as much as they do with human services, i.e., customers tend to tip less, and this decrease in reciprocity might lead to a lower income for the employees. Thus, a follow-up strategy could be to implement a policy that ensures fair wages for the human employees.

Even after companies and enterprises decide to implement A.I. and robots as part of their frontline services, they might then wonder what kind of services or features the robots should take on. Findings from this chapter suggest that simple, utilitarian tasks are better than complex, socially interactive tasks. Customers tend to correlate the services provided by a robot as a means to an end, that is, the essential, functional components that satisfy the bare minimum of a service, e.g., checking in and room service delivery during a hotel stay. In contrast, when customers prefer services by human employees, they expect social interactions and complex, cognitive services, such as cordial professionalism, personalized greetings and conversations, or even breakfast recommendations. Thus, this chapter recommends companies and enterprises to focus on functional, utilitarian, non-social aspects of their frontline operations that can be easily standardize as they deploy their robotic technologies.

Figure 1. Study 1 stimuli: Image of a service robot delivering room service
Source: ZDNet.com, 2016

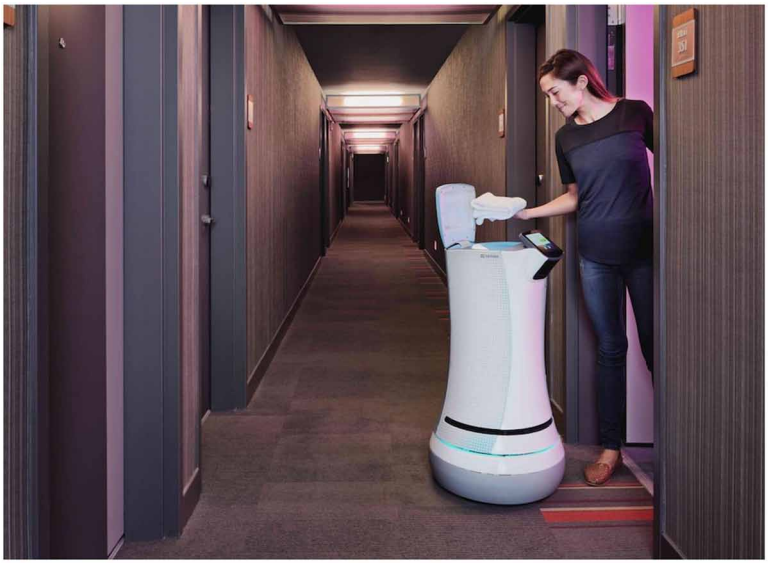


Figure 2. Decision tree based on the Classification and Regression Tree (CART) analysis

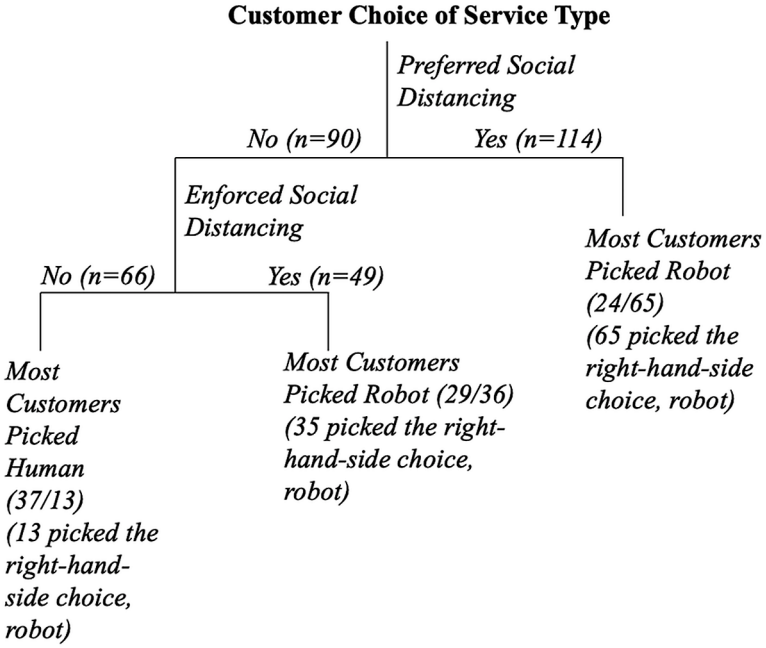


Figure 3. Word cloud of top keywords from reviews of Yotel Hotel, New York City, that mention robotic services (robot-focused reviews)

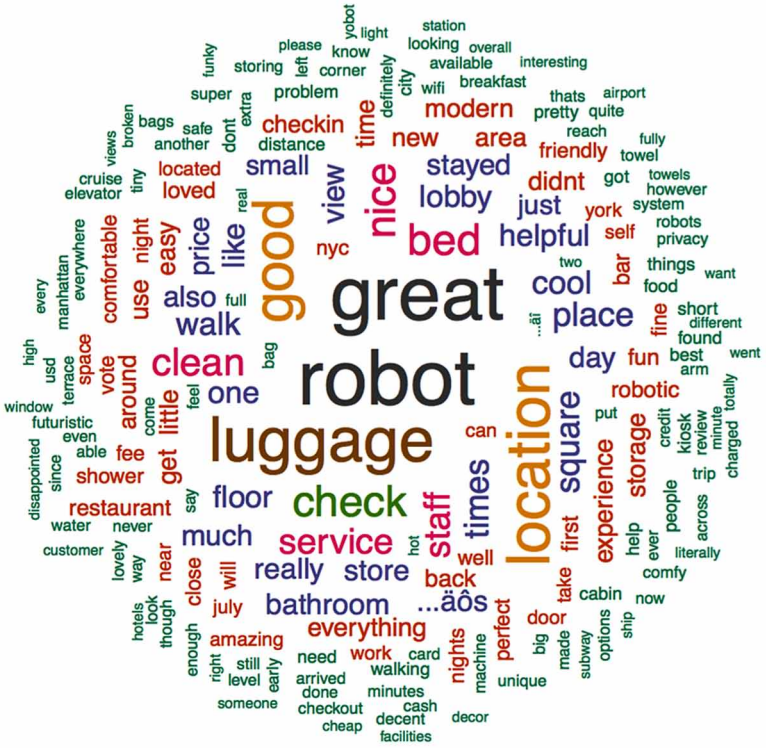
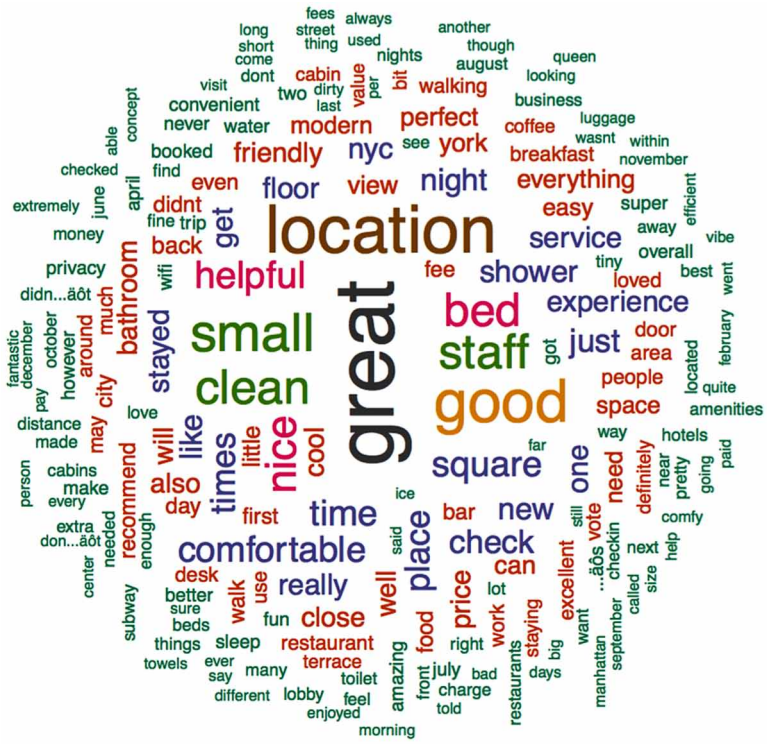


Figure 4. Word cloud of top keywords from reviews of Yotel Hotel, New York City, that do not mention robotic services (human-focused reviews)



FUTURE RESEARCH DIRECTIONS

Digital and A.I. transformation of frontline services is a nascent field. There is much more research that can be done on this topic. One, besides social distancing, drivers such as customers' empathy for the human employees, fears of job loss, and technology anxieties can help or hinder their acceptance of robotic services. Two, understanding the "digital divide" and how it differs depending on customers' cultures and backgrounds is critical in ensuring the success of deployment of A.I. and robotic services. According to Pew Research (Perrin, 2016), English-speaking Asian Americans are more likely to use Internet-connected technologies such as computers and mobile devices than other racial and ethnic groups. Depending on the enterprise's customer profiles, it might need to account for its customers' propensities to adopt and use new technologies before deployment. As such, understanding why and how these background and ethnic differences could be important. Lastly, from the perspectives of service attributes, this chapter shows that focusing on the utilitarian aspects of a service is correlated with customers' preferences for and uses of robots. However, when customers prefer service uniqueness, they might resist A.I. and robotic services (Longoni et al., 2019). Understanding how a company can adjust to servicing unique needs using digital technologies and transformational management tactics is yet another important topic worthy of research and exploration. While this chapter touches on customers' expectations, further research and a fuller understanding can help an enterprise plan and deploy digital technologies, A.I., and robots even more successfully. All of these future research directions are worthy

of in-depth investigations, which can potentially yield meaningful insights and help a business enterprise transform and manage its digital strategies.

Table 1. Customer choice of service type: estimation results of the logistic regression

	Coefficient Estimate	Std. Error	*p*-Value
(Intercept)	−18.1275	956.4810	0.984879
Enforced Social Distancing	1.492***	0.4389	0.000675
Preferred Social Distancing	2.1402***	0.4974	1.69e-05
Enforced x Preferred Social Distancing	−1.3055	0.6696	0.051198
Is Not Male	0.0262	0.3306	0.936842
Is Male	(baseline)		
Aged 18to24	0.3225	0.7609	0.67171
Aged 25-34	−0.3334	0.7822	0.669901
Aged 35-44	0.5882	0.9084	0.517325
Aged 45-54	0.6652	0.9792	0.496917
Aged 55+	(baseline)		
Income <25K	16.6457	956.4806	0.986115
Income 25-35K	17.0143	956.4807	0.985808
Income 35-50K	17.6211	956.4808	0.985301
Income 50-75K	17.2523	956.4808	0.985609
Income 75-100K	15.3883	956.4816	0.987164
Income 100K+	(baseline)		

Statistical significance: ***p < 0.001, **p < 0.01, **p < 0.05

CONCLUSION

This chapter presents both important concepts and empirical findings to investigate when and how robotic services should be deployed in frontline services. Specifically, when customers prefer social distancing, they prefer robots over humans. When social distancing is enforced, customers also choose robots for service delivery. When using robotic services, customers focus on their utilitarian aspects and functional operations. In contrast, when using human services, customers expect and appreciate interactions and friendliness. Customers are more likely to reciprocate and tip human employees than robots.

Consequently, digitalizing frontline services with robotic technologies could lead to diminishment of reciprocity and a decline in tipping behaviors from customers. All of these discoveries are important in determining how to mold and adapt the proliferation of robots in customers' daily lives, as companies and enterprises transform their operations with digital, A.I., and robotic technologies.

Table 2. Customer choice of service type: estimation results of the logistic regression

	Coefficient Estimate	Std. Error	*p*-Value
(Intercept)	2.0905*	1.01721	0.0412
Choosing Robot over Human	−0.75383***	0.14561	5.77e-07
Enforced Social Distancing	0.08872	0.18272	0.6279
Preferred Social Distancing	0.13083	0.20415	0.5224
Enforced x Preferred Social Distancing	−0.13402	0.2684	0.6181
Is Not Male	0.08114	0.13617	0.552
Is Male	(baseline)		
Aged 18-24	0.12076	0.93634	0.8975
Aged 25-34	−0.05385	0.94149	0.9544
Aged 35-44	−0.06443	0.96232	0.9467
Aged 45-54	−0.16279	0.97074	0.867
Aged 55-64	−0.07118	0.98808	0.9426
Income <25K	−1.0905*	0.43265	0.0125
Income 25-35K	−0.67115	0.45124	0.1386
Income 35-50K	−0.92621	0.47635	0.0533
Income 50-75K	−0.97758	0.4958	0.0501
Income 75-100K	−1.27629	0.68935	0.0657

Statistical significance: ***p < 0.001, **p < 0.01, **p < 0.05

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KEY TERMS AND DEFINITIONS

Artificial Intelligence: A system that mimics human intelligence, with the capabilities to interpret, learn, and adapt from data, and then work on tasks traditionally performed by humans.

Enforced Social Distancing: Humans purposefully distance themselves from each other due to necessity, e.g., a potential threat from a contagious disease.

Hospitality Frontline Services: Hospitality typically involves interactions or relationships between a guest and a host, e.g., a hotel. These types of interactions are carried out as service requests and accommodations, which can be made by human employees or service robots. Human employees that perform these direct interactions with a hospitality enterprise's customers are referred to as frontline employees.

Preferred Social Distancing: Humans distance themselves from others because they prefer isolation over group interactions. This preference can be due to social anxiety, i.e., a personal fear or perceived threat in a social situation, and it can be triggered by personality traits, psychological disorder, or perceived discriminatory experience, such as social prejudice, cultural differences, sexist, ageism, or racism.

Reciprocity: The act of providing incentive or reward to receive good service.

Service Markets: Markets that are centered around providing services to consumers or other businesses. Typical service markets include entertainment, hospitality, finance, or health care services.

Service Robot: Mechanical machinery that is capable of both movement and artificial intelligence. A service robot can communicate and interact with humans as it provides services that are useful to humans by carrying out their requests.

Social Anxiety: Fear of social situations that involve interaction with others.

Utilitarian Expectations: When customers consume a product or service, they focus on the utilitarian and functional aspects of the consumption, i.e., the attributes of the product or service that directly apply to the goals or outcomes it provides. For instance, easy check-ins and luggage delivery are utilitarian functions when customers stay at a hotel, and they expect these types of goal-oriented needs be satisfied. In contrast, when customers focus on experiential expectations, they focus on the interactive, experiential, sensory aspects of the service, e.g., interacting with the service staff or trying out recommended local restaurants.

Chapter 4
Blockchain for Education Enterprises:
A Digital Transformation Perspective of Strategic Learning

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ABSTRACT

Education enterprises (e.g., schools, universities, online platforms) seeking digital transformation require careful evaluation of their strategies and transformative capabilities. Although transformation of teaching routines is slowly evolving into student-centric learning, individual-oriented learning routines (assess, evidence, credentials) are complex to manage compared to established teaching routines (define, engage, and enhance) using existing digital learning management systems. This has resulted in poor tracking of 21st century skills (21C) of learners, which are highly sought by teachers, learners, and employers. Based on reviews of blockchain use cases from the education literature, this study proposes a blockchain for education learning ledger (BELL) model to capture and track 21C skills demanded by Industry 4.0. The BELL model includes an innovative assess skills chain for developing strategic learning capabilities and enabling reconfiguration of learning outcomes.

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INTRODUCTION

Digital learning management systems enable effective communication and interactive information flow between students and learners (Al Amoush & Sandhu, 2020), thereby contributing to the development of learning strategies in education enterprises. In the education domain, learning is a transformative process of gaining knowledge and skills and occurs predominantly at an individual level. The costs and implications related to the complexities in the process are reflected in the graduate recruitment and training expenses incurred by employers, which include employee selection, hire, and training. This creates additional pressure on developing hyper-dynamic innovations for the digital economy as well as developing 21st Century (21C) skills (Rotherham & Willingham, 2010) demanded by Industry 4.0.

Industry 4.0 is described as a global transformation of the manufacturing industry with the integration of digital innovations such as the cloud, Big Data, Internet of Things, artificial intelligence, and blockchain. These transformations are considered revolutionary improvements in the design and manufacturing processes, operations, and services of products and services (Tjahjono et al., 2017). The impact of Industry 4.0 on human labor and work organization identified the need for continuous learning, training, and education so that the future workforce can effectively adapt to work routines (Bonekamp & Sure, 2015). A recent review of 21C skills development in education enterprises shows that content related to 21C skills (communication and collaboration) is largely under-reported (van Laar et al., 2020) compared to technical skills such as problem-solving. Therefore, digitization of learning is necessary to ensure that the development of necessary skills and competencies address the skills gap (Jagtap & Adhikari, 2019).

Based on the above, this study posits that strategic learning is required by both individuals and organizations, given the increasing embedment of robotics, artificial intelligence, and machine learning algorithms in Industry 4.0 jobs.

Education enterprises are key contributors to the development of skills for all learners. These enterprises are digitally and strategically transforming their core delivery models. Digital education enterprises that offer *massive open online courses* (MOOCs) have witnessed a significant increase in users (i.e., learners) who want to pursue their studies at their own pace and time. For example, learners of Coursera, a leader in online education, grew from 26 million in 2017 to 40 million in 2019. In addition, worldwide outbreaks, such as the ongoing COVID-19 pandemic, have triggered traditional education enterprises (e.g., schools and universities) to deliver their teaching content online through digital platforms such as Zoom. Thus, education enterprises have been active in transforming teaching capabilities through the hyper adoption of cloud services and are leveraging the flexibility of such online mediums (e.g., 24/7 access and ease of use) through micro-credential offerings. However, the ongoing digital transformation of teaching in traditional universities and the MOOCs platforms (e.g., Coursera and Udemy), in developing skills and capabilities of digital natives' (i.e., 21C learners; Prensky, 2001) and their learning routines, is largely under-researched and not clearly understood.

Recent studies on strategic renewal of learning models by universities identified six distinct themes viz., *specify, engage, assess, evidence, credential*, *and enhance*, which address the lifelong learning needs of 21C learners (Oliver, 2015, 2019). These are also deemed important for building learner's readiness for Industry 4.0 employment. Our study selected *assess*, *evidence*, and *credential* as core themes, as they focus on the development and measurement of skills. Besides, they also cover the transactions associated with the learning processes through assessment evaluands such as, for example, declaration of the learning outcomes, design of assessments, assessment evaluation criteria, and the evaluation of learning outcomes. The scope of activities covered by the chosen themes are:

- **Assess:** Create authentic tasks, create artifacts that demonstrate graduate capabilities.
- **Evidence:** Curate and communicate relevant artifacts to demonstrate graduate capabilities.
- **Credential:** Demonstrate warranted achievement in trustworthy and meaningful ways.

Blockchain is a foundational technology, which businesses strategically adopt to secure and improve their business processes. Presently, it has transitioned from the "group of innovators" to early adopters in the innovation diffusion lifecycle (Stratopoulos et al., 2020). Blockchain (Nakamoto, 2008) has become a popular digital mechanism due to the impact and valuations of Bitcoin, a popular blockchain application. Its potential opportunities, advantages, and influence over enterprise strategies have been well described in many management domains (Catalini & Gans, 2016; Riasanow et al., 2018; Tapscott & Tapscott, 2017). Though blockchain has been defined in many ways, this study adopts it from a foundational institutional technology perspective (Davidson et al., 2018). This advocates that blockchain can enable education enterprises to sense, seize, and reconfigure (Teece, 2007) digital transformation processes in any functional area (Iansiti & Lakhani, 2017).

Blockchain, as a disruptive innovation, offers valuable actions such as, for example, distributive ledger, immutability, and transparency (Constantinides et al., 2018), for enabling digital transformations (Eyal et al., 2016). These actions can also be utilized for addressing the Industry 4.0 needs such as *transactional security*, *fostering trust*, *facilitating networking*, and *innovation* (Iansiti & Lakhani 2017; Tapscott & Tapscott 2017). Since blockchain also offers both trust and immutability, a blockchain-based model can enable learners to digitally demonstrate evidence of their skills gained in any study program undertaken at a university (Swamy & Parmar, 2020).

Based on the utilitarian value of blockchain, this study proposes a blockchain-based model for addressing the 21C skills development strategy of education enterprises. This view is aligned with the blockchain for an education study by Grech & Camilleri (2017) that identified the need for continuous professional development to fulfill Industry 4.0 demands. Further, the study found that re-skilling the organization's workforce requires:

1. Recognizing the formal and non-formal learning of individuals, and
2. Standardizing credentials and enabling access by third parties such as employers, business organizations, and government institutions.

Based on the above, this study investigates a key research question: *How can education enterprises strategically develop and digitally transform learning models to secure and assure learners' 21C skills?*

This study addresses the above question through the novel use of blockchain. First, it conducts a concise literature review of blockchain use in education and selects a set of use cases. Second, it establishes a robust process to evaluate whether blockchain is fit for purpose in the selected use cases. Third, based on the analyzed blockchain use cases, it proposes a blockchain for education learning ledger (BELL) model as a viable solution for strategic learning that can be implemented by both education enterprises as well as digital natives.

BACKGROUND

Industry 4.0 and 21C Skills

In 2019, Apple, Google, Microsoft, Amazon, and Facebook were listed by Forbes (2019) as the most valuable brands. These firms, with combined revenues totaling $750 billion (2019), evidence the digital revolution to be the driver of economic and social change in the 21C. These firms have also triggered innovative mainstream changes such as Industry 4.0 for manufacturing and supply chain organizations. The World Economic Forum's (2018) "Future of Jobs" report projects the rapid evolution of machines and algorithms and predicts its impact through the displacement of 75 million job roles by 2022 and their subsequent replacement by 130 million new roles It also states that 54% of employees in large firms would require re-skilling. Therefore, the quest for prospective employees with 21C skills such as *creative design*, *critical analysis*, *problem-solving*, *collaboration*, and *communications* is a high priority for employers. A review of the consequences of Industry 4.0 on human labor and work organizations identified the need for continuous learning, training, and education. It states their importance in enabling the future workforce to adapt to work routines (Bonekamp & Sure, 2015).

In light of the above, education enterprises play a strategic role in the development of skills and knowledge of learners. These enterprises drive the integration of technology and teaching pedagogies, which in turn evolves through the digital transformation of their capabilities. Based on the analysis of five models of digital integration, the technology integration matrix (TIM) model provides optimal strategies for transforming education enterprises' capabilities (Bonfiglio-Pavisich, 2018). This study observes that active, collaborative, constructive, authentic, and goal-oriented approaches make novel use of digitalization to support student-centric learning transformation strategies. However, measuring the effectiveness of how students are learning and developing 21C skills and their long-term impact remains elusive.

Scholars have studied the dropout rates (Jordan, 2014) and limited engagement by students in online courses (Gamage et al., 2015). While weak teaching and learning models and strategies are perhaps partly responsible for this, value creation and realization on both sides (i.e., teaching institutions and fee-paying students or customers) have become a critical issue in improving the strategies employed by education enterprises. Though transactional benefits resulting from the effective use of digital mechanisms and systems (e.g., 24/7 availability, ease of access, and customization of learning contents) are already being leveraged for teaching routines by education enterprises, measuring and tracking learning outcomes and their impact on student's skills development remains largely unknown.

Setting up learning outcomes and validating them through a set of assessment activities has become routine practice in many universities. However, learners remain unclear on how they can achieve established learning outcomes. In this regard, a recent study on micro-credentials in Australia (Oliver, 2019) identified two specific challenges in acquiring formal academic qualifications and 21C skills. First, assessment items, which are designed to validate learning outcomes at the unit and course levels are controlled by individual education enterprises. As these are not available for public scrutiny, learners are unable to quantify the skills gained from a study program and align it with specific employers' job requirements. Second, course transcripts and academic credentials are codified with the unit titles of knowledge areas and earned degrees. However, they do not substantiate the outcomes or skills gained by an individual learner. In addition, if the credentials are not machine-readable, then employers and universities require additional resources to validate those in order to stop fraudulent practices.

The BELL model proposed by this study addresses the above-mentioned challenges by (a) providing visibility of the skills development activities in educational enterprises, and (b) enabling learners to provide immutable evidence for their skills claims. Thus, it enables education enterprises to plan and implement student-centric learning transformation strategies.

Digital Transformation for Student-Centric Learning Strategy

Digital transformation is a process, which aims at improving an organization by triggering significant changes through a combination of information, computing, communication, and connectivity technologies (Vial, 2019). A recent study on digital transformation as a process explicates its contribution to developing dynamic capabilities for the strategic renewal of established institutions (Warner & Wäger, 2019). Within the education enterprises context, strategic learning is viewed as a dynamic capability that can contribute to sustainable differentiation of organizational performance, which is enhanced by the strategic adoption of technologies (Thomas et al., 2001). Extant literature on dynamic capabilities evidence how strategic adoption of digital technologies can enhance organizational learning. Due to the ongoing digital revolution, education organizations need to "sense" (Helfat & Peteraf, 2015; Teece, 2007) technology opportunities and invest in developing strategic learning capabilities. This will enable organizations to offer lifelong learning processes to re-skill their employees. Oliver's (2019) study proposes micro-credentials for potentially addressing challenges to lifelong learning as a way of life in the 21C. It proposes three steps.

1. Credit a national credit framework.
2. Create catalysts for the recognition of prior learning for mature learners.
3. Implement lifelong learning accounts.

This study proposes a digital trust-based foundation with a blockchain model (BELL) to address the above-mentioned three steps. The proposed BELL model can be utilized by education enterprises for developing strategic learning capabilities, as it provides a foundation for implementing a student-centric learning strategy.

Blockchain for Strategic Learning Capability

Blockchain is essentially a distributed ledger of transactions related to the transfer of digital assets. It provides reliable, secured transaction guarantees through either a public (permissionless) or private (permissioned) consensus model (Yaga et al., 2019). The independent time-stamping feature of blockchain also provides significant security benefits (Grech & Camilleri, 2017). With blockchain, the individual identities of the parties involved in a transaction are masked through the public and private key mechanisms to address privacy concerns. Hence, blockchain offers *security*, *privacy*, *transparency*, *reliability*, *flexibility*, and *decentralization* features (Scholz & Stein, 2018; Tapscott & Tapscott, 2017; Yaga et al., 2019). These six features are useful in establishing a distributed ledger of immutable transactions related to the value exchanges of digital assets. However, this emerging technology is constantly evolving after the enormous success of Bitcoin in the financial domain. Therefore, education enterprises would need to evaluate these features to ensure that they are fit for a purpose relating to their specific needs.

A blockchain is essentially a public ledger of all transactions or digital events that have been executed and shared among participating parties (Iansiti & Lakhani, 2017). These ledgers are generally used as foundational mechanisms for tracking transaction costs in firms. A secure and immutable network-based ledger (blockchain) can be leveraged by any organization to record, monitor, and report value exchanges in real time. Although blockchain offers unique features, education enterprises need to significantly reconfigure their services and platforms to leverage value through its (i.e., blockchain) use. Hence its use for storing and tracking specific transactions needs to be carefully evaluated based on the cost and complexity of a proposed implementation and the ongoing developments of this technology.

Next, this study presents different scenarios in which blockchain is analyzed in the education domain based on specific reviewed literature. Thereafter, an 8-step process model (see Figure 2) is presented and utilized for evaluating which assets and transactions are fit (and can benefit) for blockchain use.

Literature Review on Blockchain Use

This study selected a set of peer-reviewed articles for investigating and reporting blockchain use in the education domain. Search queries were conducted using primary search resources such as Google Scholar, ABI/Inform, and A+ Education databases. The search used multiple filters, including a chronological filter for accessing results from the year 2017 to 2020. The search period was limited to three years in order to capture recent advancements within constantly evolving blockchain-based applications. Other search filters were also used, such as *sort by date, include citations, only results including peer-reviewed academic papers*, *articles*, and *books*. Key search words and phrases included *blockchain for education* and *blockchain technology for academic records*. Primary keywords used included *blockchain*, *education*, *academic*, and *education records*. The search identified a total of 50 studies. Based on relevance, 20 studies were selected for further analysis. The relevancy was based on the comprehensive use of blockchain, wherein all its six features (see the previous section) were utilized to address a problem in the education industry context. The evaluation was conducted by two scholars authoring this study and was further reviewed by a third scholar for ensuring due diligence in the selection process.

As the selected articles covered multiple transactions through their use cases, a second round of filtering was conducted to identify use cases that closely related to this study's focus analysis themes: *analysis*, *evidence*, and *credential* (Oliver, 2015). Based on this filter, 16 use cases were extracted (described in the next section) and further evaluated using an 8-step model. The model was developed by selecting and refining the relevant conditions from two other evaluation models that used 6 and 10 steps, respectively.

BLOCKCHAIN USE IN EDUCATION (USE CASES)

P1. *Study on Issues and Challenges of Blockchain Technology in Malaysian Higher Education Institutes (Mahmood et al., 2020)*. This study looked at significant issues and challenges of blockchain technology. The paper looked at six issues and challenges, which included scalability, integration, data privacy, security, latency, and standardization problems. Findings reveal scalability and data privacy issues as problematic areas, which could affect the integration of this technology within higher education institutes in Malaysia.

The study discusses the need to share transaction records, namely, academic accreditations. It describes how records could be issued to the blockchain by more than one entity. Trust issues are discussed as well as the need to make records immutable due to sensitive information and privacy concerns. The benefit of blockchain includes using a tamper-proof log file, which provides an additional security level. The study argues that records need to be accessed by certain users, including students, universities, and invited entities such as prospective employers. Other issues discussed include scalability, transparency, and sustainability. Analysis of this use case indicates that the best blockchain model for this type of scenario would be a permission-based blockchain model.

P2. *A Blockchain Technology into Gamification on Education (Aini et al., 2020).* This article examined learning methods that are currently used at several universities in Indonesia. These entities use conventional methods in teaching and learning, which create conditions that lead to stress within the student population. The study looked at gamification in education as a new method of learning management by adapting elements in games that increase student motivation and reduce stress. The study argues that the new concept of management of learning, when coupled with blockchain, helps in increasing engagement and reducing student stress.

The study researches the process of sharing academic achievements in a gamification model. Only one entity would issue records to the ledger, which in turn would be displayed as a score for all students to see and compete. Records were immutable so that no players (students) or administrators could modify or delete them. Since the study was based on increasing student engagement and decreasing stress, the need for privacy and security was not a priority. To conclude, the analysis of this use case indicates that the best blockchain model for this type of scenario would be a permission-less based blockchain (public) model.

P3. *Application of Blockchain Technology for iLearning Student Assessment (Sudaryono et al., 2020).* This research looked at the implementation of blockchain technology within the field of education, specifically in the application of data security. The study used two methods for analysis: mind mapping methodology and literature review. The study findings concluded that blockchain helped in securing data from cyber attacks, as the technology included encryption and a decentralized data management system.

The study investigates securing transactions and recording them via a hash stored on the blockchain. It mainly focuses on authenticating grades through the comparison of hashes to prove that records are not altered. This storage on the blockchain with immutable records is an important aspect of the investigated problem area. Further, it finds that records can be accessed by the public (can view only a hash), but only privileged users can view the record contents. Multiple users classified as *privileged* (e.g., entities within universities) can add transactions. All log files could be tamper-proof and usable for future audits. As the public can access the hash stored on the blockchain but not read, the content of the hash makes this a permissionless blockchain model.

P4. *Revocation Mechanisms for Academic Certificates Stored on a Blockchain (Vidal et al., 2020).* The researchers looked at applications built with blockchain technology. Further, it studied challenges and limitations while performing corrective operations on databases. It examined problem areas of

blockchain characteristics such as immutability, and how it affects corrective operations to existing data while maintaining privacy. It concentrated on higher education (key research domain) and the use of blockchain to issue academic certificates. It proposed a mechanism for recording problematic digital diplomas and revoking any incorrectly allocated data.

The paper discusses different goals necessary for sharing transaction records while maintaining privacy. In order to accomplish this, a permission-based blockchain model is needed. Trust is also considered as a property of a decentralized, immutable blockchain ledger, which is necessary as sensitive data and identifiers would be stored on the blockchain. Given the type of system and actions required to accomplish it, multiple entities need to be added to transactions in a record. Also, as transaction access is required, a permission-based blockchain system is proposed.

P5. *Using Blockchain, Semantics and Data Analytics to Optimize Qualification Certification, Recruitment and Competency Management (Kontzinos et al., 2020).* The authors investigated innovative technologies and how they have transformed areas of higher education, specifically the certification of degrees, qualifications, and other accreditation for students and job seekers. The paper claimed that a majority of accreditations were largely in a paper format requiring manual and time-consuming processes and methods for distribution. The study examined the growing need for automatic and trustworthy systems to manage the problem of handling qualifications and certifications. Blockchain was discussed as a means of distribution, storage, and security of digital student records and certifications.

The paper focusses on the importance of minimizing fraudulent academic certifications. It investigates records sharing for a specific subset of users in order to create a system where students and employers could communicate and exchange data quickly and securely. Trust, scalability, and privacy aspects of a blockchain model with immutable records and log files is studied. While this system is not public, it can be controlled by parties with privileges that allow for a variety of services. Based on the study areas, a permission-based blockchain model is considered as appropriate architecture.

P6. *Blockchain in Education (Grech & Camilleri, 2017).* The authors researched blockchain opportunities in disrupting traditional products and services based on its properties, such as its distributed and decentralized nature, permanence of records, and smart contracts. The report found how these properties make blockchain technology-based products or services significantly different compared to current forms of legacy products and services within the education sector. It observed that stakeholders within the education sector were largely unaware of the potential and social advantages of blockchain. Other aspects of blockchain discussed included forecasting any activity founded on time-stamped record-keeping of titles of ownership. It also studied activities likely to be disrupted by blockchain, such as licensing and accreditation, intellectual property management and payments, the award of qualifications, and the management of student records. It concluded that although blockchain applications for the education sector were still in their infancy, the technology would increasingly affect all management systems as it progressed.

The study discusses the multi-party sharing of translations by students, academics, and universities. While maintaining privacy for sensitive information, the aspect of trust is gained via a decentralized

network and immutable records on the ledger. It covers the need for multiple owner access and the ability to control transactions and aspects of the ledger. Based on the above, an appropriate blockchain model could be permission-based architecture.

P7. *Applying Blockchain Technology for Improvement of the Educational Process in Terms of Data Processing (Zimina & Mouromtsev, 2019).* This paper considered new methods for blockchain use as a tool for improving the educational process management system. It discussed two e-learning problems, viz., low ratings of completing MOOCs and the need for detailed and accurate reports. It mainly focused on the application of blockchain technology to leverage the mentioned problems. Two blockchain use cases were discussed: (a) making educational reports more detailed and easier to design, and (b) using blockchain for creating adaptive education models for making electronic educational courses more effective to increase completion ratings.

The study examines the ability of blockchain to share student credentials and qualifications transaction records. This record sharing would be for privileged users while maintaining the privacy of students. Trust and an immutable ledger allow for the authenticity of authors, thus ensuring ownership. A tamper-proof log file and limited access to records mean that this system would need a permission-based blockchain network.

P8. *Truver: A Blockchain for Verifying Credentials (Taha & Zakaria, 2020).* The authors argued that during a job application process, applicants use resumes, certificates, recommendation letters. However, the legitimacy of academic documentation is not easily verifiable by employers, as current verification processes are inefficient, time-consuming, and expensive, often resulting in delays and expensive human resources processes. To address this problem, a proprietary application called Truver (blockchain-based platform) is discussed. The application provides a distributed and secure way of sharing verified academic credentials.

The paper discusses the sharing of transaction records for verifying the authenticity of the owner and the record data. In some cases, multi-party access is necessary so that a specific entity can add data (e.g., accreditation records) relating to the entity. Each record is immutable as per the nature of blockchain. Transactions store sensitive identifiers as proof of ownership, and a tamper-proof log file can be used for auditing data if necessary. This system could use the Ethereum blockchain as the architecture. It is a permissionless system that also uses smart contracts for transactions.

P9. *Exploring Blockchain Technology and its Potential Applications for Education (Chen et al., 2018).* This study discussed the history of blockchain technology from cryptocurrencies and its increased use in various domains such as finance, judiciary, and commerce. It focused on the potential of the technology in the educational sector and its application in resolving existing problem areas. It discussed blockchain features and advantages as well as its application in education. The study concluded with some innovative applications of blockchain, including benefits and challenges in the education sector.

The study examines the use of blockchain for authenticating and sharing transaction records on a permissionless based blockchain system. It further discusses the ability of multi-entity access to transactions

relating to students, universities, and employers. It studies the trust benefit resulting from immutability and explains its critical importance in securing transactions with log files. This is a permissionless blockchain system that includes the use of smart contracts and allows multiple parties to access specific data depending on their permission status.

P10. *Applications of Blockchain Technology to Education Policy (Machado et al., 2019).* Within the education sector, blockchain technology can have multiple applications for both students and teachers. The technology can help in many innovative ways, such as in the application of diplomas and the management of achievements and assessments. It can be used for formative evaluations, learning activities design and implementations, and tracking learning progression. This research focused on the scientific production of blockchain within the education sector using bibliometric analysis. Literature analysis identified problems and made recommendations for new policies to include blockchain applications to replace legacy systems, processes, and related policies.

The authors discuss storing student credentials in a scenario where multiple users can add records to a transaction with an immutable log and transaction ledger, thereby allowing for transparency of use and ownership. Transactions would be open to the public on a blockchain system. However, different process levels would restrict access and content viewing unless proof of ownership via an authentication process is granted.

P11. *Tamper Proof Certification Authentication Using Blockchain Technology (Rukumathi & Manohar, 2020)*. The authors argued that as education diversifies, the need for ensuring trust and authenticity becomes critical. Due to the demand for instant availability of credentials and proof of completion, a system is required that allows the transfer and validation of all important documentation. Blockchain can resolve these issues by making data immutable and unalterable. It can restrict fraudulent activities through secure applications of encryption, decentralization, time stamps, and other verifiable processes. This type of system can save valuable resources for organizations and increase trust in document authenticity.

The study investigates the use of blockchain for sharing academic record transactions on an immutable, transparent platform. The records would contain sensitive identifiers to create trust through transparency and authentication of ownership. The study discusses a blockchain system that allows multiple owners to add records to a transaction and the inclusion of a transaction log that proves activity on the ledger. The study labels the system as public but does not examine the properties of permissioned or permissionless aspects of system architecture.

P12. *Blockchain 4 Education (Kolvenbach, Ruland, Gräther, & Prinz, 2018)*. This study discussed how certificates and credentials play an important role in the education sector and companies. It analyzed long-term storage of academic records on tamper-proof ledgers and examined how training facilities, academic institutions, and certification authorities issue paper-based certificates and accreditations. Further, it discussed how blockchain technology could enable the transformation from legacy formats like paper certificates to digital certificates. It presented a "Blockchain for Education" platform as a practical solution for managing, monitoring, validating, and sharing academic accreditations. The proposed solution represents paper-based academic accreditations

in a digital format and a fingerprint for each record in the form of a unique hash. Finally, the study discussed the smart contract and its role in supporting certification authorities and monitoring and revocation of certificates.

The study proposes a blockchain system based on the Ethereum model where smart contracts allow sharing of transaction records and provide multiple parties access to add transactions to the ledger. All records on the ledger can be immutable, and a tamper-proof log file can show activities. Records would include identifiers, which add trust to the transparency of data on the ledger. The study does not state whether the system would be permission or permissionless. However, in general, Ethereum systems are permissionless.

P13. *Blockchain for Education: Lifelong Learning Passport (Gräther et al., 2018)*. This study investigated the importance of academic records and problem areas related to storage, validation, and communication of certified documentation within the education sector and prospective employers. Academic records are essential for students and professionals in their selected area of vocation. As these records increase based on the extent and duration of studies, new processes need to be implemented to replace existing legacy systems. Based on the importance of these documents, the study argued that it is also important to use a system that provides long-term tamper-proof storage. It further stated that blockchain allows for long-term availability and storage of immutable records within the blockchain ledger. It discussed a blockchain for education platform that can be used as a practical solution for issuing, validating, and sharing certificates.

Content covered in this study includes details and a proof of concept based Ethereum model, which allows the use of smart contracts for managing certifications, records, and users. Transaction records can be shared, provided the entity has permission driven via smart contract entities. Multiple parties can add transactions, and all activities could be logged in a tamper-proof file. Multiple owners can add transactions to a record provided they have permission to access the record. The system is public, but without special privileges, it cannot provide access to sensitive data.

P14. *Blockchain Technology Applications in Education (Sharma et al., 2019)*. This study researched the transformation of distance education and its evolution to online learning over the past 25 years. It examined the use of blockchain technology to understand how it affects methods of collaboration through lesson materials. Further, it also examined the grading and certification processes. The authors argued that blockchain would affect the transparency and veracity of records, including micro-credentials in the context of lifelong learning. The study posed questions and offered solutions to resolve aspects of trust, transparency, and threats from malicious activity. It also examined the management of a decentralized system of records, which is the nature of a blockchain environment.

The authors cover various aspects of a blockchain system for education, such as the core features of blockchain use. They comprehensively explain (a) transactions sharing over the network, (b) adding transactions by multiple parties, and (c) excluding private identifiers with cryptographic hash functions for making it viable for all parties to add transactions to the ledger. The study covers all types of blockchain models and provides an outcome for each model.

P15. *EduRSS: A Blockchain-Based Educational Records Secure Storage and Sharing Scheme (Li & Han, 2019).*This study discussed the importance of accurate and complete educational records as a valuable asset for students and professionals. It researched issues relating to the digitization of academic records and highlighted two key unresolved challenges: (a) achieving secure and privacy-preserving storage of educational records, and (b) achieving the sharing of educational records while ensuring security during the sharing process. Further, it discussed EduRSS, a blockchain-based storage and sharing system for academic records, combining blockchain servers and cryptography techniques for creating a dependable and trusted environment. In addition, it provided a proof of concept design to assess the effectiveness of EduRSS. In conclusion, the study demonstrated the EduRSS system as being safe with a lower computational cost compared to CP-ABE and the MA-CPABE schemes.

The study depicts materials covering the sharing of transaction records and the need for multi-party access to transactions and records. It includes a cross-institutional aspect covering a broad scope of educational accreditation. All records in the system are immutable as per blockchain protocols and contain identifiers for authenticating the owner and the author of the accreditations. This indicates multiple owner access to individual records while maintaining a tamper-proof log file for activity, which represents trust. The study covers all permission-based and permissionless blockchain models.

P16. *Secure and Decentralized Academic Transcript System Based on Blockchain (Swamy & Parmar, 2020)*. This study examined the problem area of educational records and the validation, communication, and trust for documentation. It argued that hard copies of academic records are easily alterable and difficult to verify. Further, it discussed the costs associated with these records (e.g., labor, printing) that institutions incur, which are passed on to students. The study discussed the application of a blockchain system (properties included trust, validation, authentication) to store student records on a ledger and argued that the system would help in lowering costs.

The study investigates the sharing of transactions between institutions and organizations, which allows multiple parties to add and access records and transactions on the ledger. Records are academic by nature with sensitive information, including identifiers for clear and transparent ownership and author accreditations. The ledger and log files are tamper-proof, and all activities can be audited. The system discussed is based on a permissionless blockchain model.

P17. *Blockchain Technology and Education (Albeanu, 2017)*. This study investigated blockchain technology as a secure distributed database inspired by the distributed ledger technology instrumental in managing Bitcoin transactions. The authors argued that the technology can be applied to other domains, such as the education sector. A list of applications included academic records management, student transcripts, degrees, test scores, record validations, transfers, educator credentials, certifications, and re-certifications. The system also supported the management and tracking of school assets such as property, buses, furniture, textbooks, library books, journals, and technologies. Further, the study discussed several issues, such as the management of student privacy issues, parental opt-in/opt-out permissions, management of special education, school lunches, attendance records, distribution of public program funds and grants, and distribution and payments for student loans, licenses, dissertations, and PhD thesis management.

This study examines a wide range of global projects in the academic sector that use blockchain systems. It covers a wide range of scope for all possibilities, including sharing transactions, how and who can add transactions to the ledger, immutability of records on the ledger, and what the records can hold. The study researches blockchain in the education sector and excludes any proof of concept or working model.

P18. *Trustless Education? A Blockchain System for University Grades (Rooksby & Dimitrov, 2017).* This study examined a blockchain system based on Ethereum as a university management system to store student grades and provide cryptocurrencies. It provided an exploratory qualitative evaluation of the system. It found problems between the university entity being the organization in the study, and the distributed autonomous organization (DAO) being Ethereum. Problems included (a) trust mechanisms, (b) scope of openness, and (c) procedures and properties. The study concluded with an outline of the implementation and evaluation process.

This study focuses on developing a proof of concept Ethereum based blockchain system to share academic records between multiple parties (e.g., students and the university). It finds the records to be controlled by the university and stored in immutable log files for transparency of activity. The proof of concept allows only one entity to manage the records using smart contracts. The study is based on a public permissionless model, with a controller being the university.

P19. *Blockchain-Enabled Digital Rights Management for Multimedia Resources of Online Education (Guo et al., 2019)*. This study discussed various online education platforms (MOOCs) such as Coursera and XuetangX. It considered the Internet environment, the range of multimedia learning resources, and challenges in digital rights management, including infringement of digital copyrights and security issues with digital academic certification. Further, it discussed a blockchain-enabled digital rights management system that includes a new network architecture for sharing and managing multimedia resources for online education. The system utilizes both public and private blockchains as well as smart contract schemes for multimedia digital rights, secure storage, and verification of digital certificates. The authors concluded that the new management system can resolve many outstanding issues in the online education and multimedia industry.

This study investigates the use of blockchain technology to stop copyright infringement in the education sector for online learning. It discusses aspects of sharing records on a blockchain ledger with multiple parties such as universities and online learning faculties that require access for adding transactions to the ledger. Records can have sensitive information, including identifiers for the student and the origin of the credential. The blockchain ledger is immutable, and the log file can be tamper-proof to uphold the trust properties of the blockchain. The study discusses a permissionless model that could use smart contracts to manage student accreditations.

P20. *Blockchain-Based Badge Award with Existence Proof (Choi et al., 2019)*. This study presented a badge awarding system for performance assessments using blockchain. The badges were trusted by open standards of IMS global learning consortium. The study developed and deployed a model with both Bitcoin and Ethereum platforms. It reported that the Ethereum implementation issued badges almost ten times faster compared to Bitcoin. Smart contract implementation is explained in detail.

The study provides information and execution details of Bitcoin and Ethereum platforms. Due to open standards, the adoption of a permissionless chain of both platforms requires careful consideration.

EVALUATION OF THE USE CASES

The U.S. Department of Homeland Security (DHS) Science and Technology Directorate proposed a 6-step evaluation process to select use cases that are fit for blockchain use (Yaga et al., 2019). The initial evaluation process model was based on bitcoin implementation of blockchain, which is considered as permissionless and open for all. However, due to subsequent developments in blockchain (smart contract, permissioned chains), a 10-step generic evaluation process was developed to consider whether blockchain was fit for purpose (Pedersen et al., 2019). Considering the rapid evolution of blockchain, both research and industry participants suggested a careful evaluation to ensure if blockchain is required in specific use cases (Yaga et al., 2019). As this study is focused on blockchain use in the education context, specifically with the evaluation of learning outcomes, it proposes a refined 8-steps process for evaluating blockchain use cases in the education sector. The refinements were needed to ensure that any decision to use blockchain should consider whether the stored transactions require all the six core features of blockchain viz., *distributed ledger*, *immutability*, *privacy*, *security*, *flexibility*, and *accessibility*. Bitcoin was projected as an alternate means for achieving trust as trust was traditionally provided by centralized governance structures. Subsequent developments (e.g., Ethereum) offered smart contracts, which enabled traditional institutions such as universities to use blockchain for transactions that require information sharing across many parties within their value chain. These are called *permissioned chains*. To enable an organization to choose between the open permissionless chains (generally consumer to consume transactions) and permissioned chains (business to consumer transactions), two more steps were added. Hence, the eight steps (see Figure 1) are organized to evaluate each use case against the above-mentioned six core features offered by blockchain. Steps 7 and 8 (see Figure 1) are designed to allow an organization to choose between permissioned and permissionless chains.

Table 1 provides a summarized analysis of blockchain use cases evaluated from the 20 use cases mentioned in the previous section. The analysis also takes into account observations made by the authors of this study.

SOLUTIONS AND RECOMMENDATIONS

Based on the analysis of blockchain use in Education (see Table 1), this study identified 12 out of the 16 use cases where blockchain's six core features are purposefully and effectively deployed for students' learning transactions. The remaining four studies conducted closed experiments and did not leverage the six features of blockchain. Hence, they may not be required to use blockchain. Based on the analysis of how blockchain can be used by education enterprises, this study makes the following observations.

1. **Blockchain** as a digital mechanism integrates six core distinct features viz., *networked database*, *immutability of transactions*, *crypto security*, *privacy* through private keys, *transparency* through public keys, and *flexibility* through 24/7 cloud access. Hence, the selected use cases will require evaluating their transactions and identifying whether they need all six features. If they require only a few, then it is pragmatic to look at other digital options rather than blockchain.
2. **The digital trust effect and transparency** through the immutable log require to be matched with the current and future use of specific assets (such as skills gained by earners).
3. **The benefits of using blockchain** for specific transactions and their associated values can only be realized over a period of time. Presenting evidence of skills developed by a learner to potential employers would generally occur when the learner is in the final semester or year of study. However, the accumulation of skills would need to start from the time the learner commences the study and end upon study completion.

Figure 1. 8-step process model for evaluating education use cases fit for blockchain

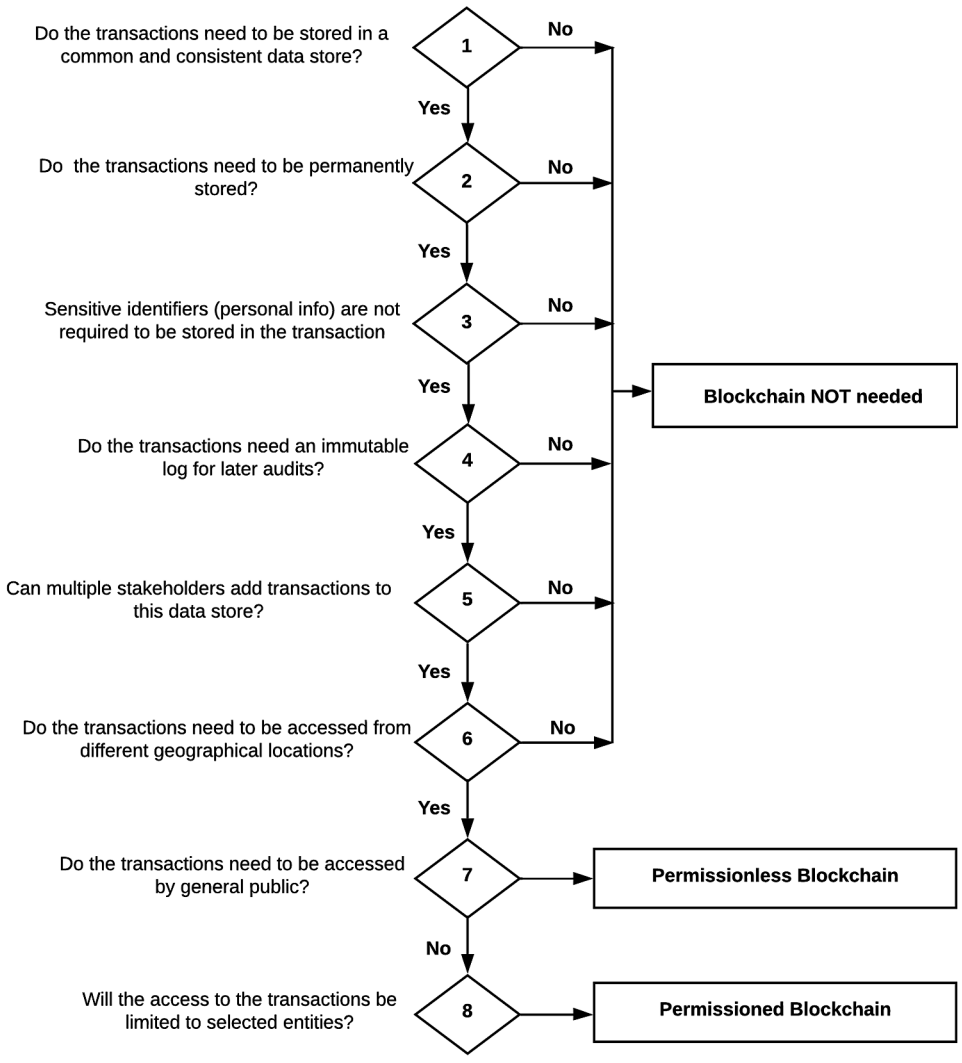


Table 1. Evaluations of the use cases

No.	Use Case Description	Organization(s)	Evaluation Results
1	Blockcerts: "The MIT Media Lab and Learning Machine, an enterprise software vendor, has developed Blockcerts—an open standard for issuing and verifying credentials on the Bitcoin blockchain (MIT Media Lab 2015; Schmidt 2016). Blockcerts is currently the only open standard for issuing and verifying records on blockchain. The goal of the Blockcerts community is to promote its adoption as the main global standard (in terms of social adoption) for issuing records on the blockchain.	MIT, Media Lab	Yes
2	Badges for micro courses and linking accreditation to student CVs	UT Austin, Open University, U.K.	Yes
3	Issuance of academic certificates into bitcoin blockchain *through an in-house platform*	University of Nicosia	No—Limited to single party addition
4	MCAST Diplomas: Recipients who choose to receive their diploma in this format can share them online or directly with others (e.g., schools, employers) in a format that can be independently verified as authentic.	Maltese educational enterprises	Yes
5	ITS training certificates	Institute for Tours and Studies	Yes
6	Equivalency statements	National commission for further and higher education	Yes
7	Accreditation and licensure	National commission for further and higher education	Yes
8	This use case discussed the need to develop a blockchain system that would allow for the validation of academic records between privileged users, as well as the *ability to revoke credentials* creating a more efficient mechanism between students and employers.	University Fernando Pessoa	No—Allows transactions to be updated.
9	Blockchain model based on Ethereum that uses time stamps and identifiers for the author to validate materials for grading	ITMO University	No—Designed for local use only
10	Blockchain used for evaluating teachers work and reward improvements with bitcoin. The system also allows sharing of work between teachers and students.	For any university	Yes
11	BSCW (Web-based groupware system) allows portfolio creation. Learners add documents to the respective portfolios and share them with potential employers. Employers can then verify the certificates by using the platform's verification service.	University	Yes
12	Students, universities, and employers can access certificates and verify their authenticity	For any University	No—Closed experiment
13	An exploratory study on the potential of blockchain in the education sector	University of Glasgow	No—Closed experiment
14	MERLN-X is a blockchain-based tool that validates multimedia resources and infringement of publication	MOOCs	Yes
15	This use case discusses a badge system for the education sector as a trustworthy certification of accreditation	Global Learning Consortium	Yes
16	Higher education use case for the gamification of education to increase interest in learning	Indonesian University	Yes

Source: Authors

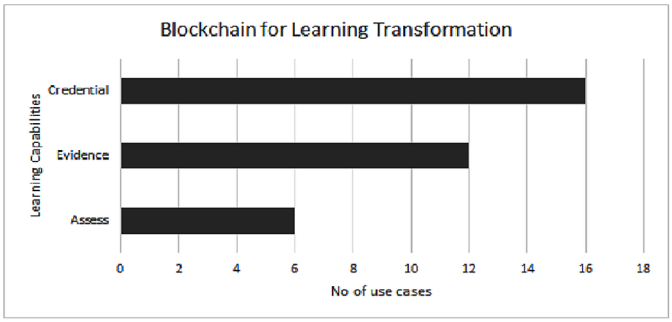
Sensing the opportunities offered by the blockchain mehanism (Teece, 2007) can enable education enterprises to develop strategic learning capabilities and allow its strategic renewal by reconfiguring it (Warner & Wäger, 2019) into student-centric learning strategies. This will enable evidence-based foundations and lifelong learning strategies of digital natives to fulfill Industry 4.0 demands.

The Blockchain for Education Learning Ledger (BELL) Model

This study identified and analyzed selected use cases of blockchain. The analysis focused on credential related transactions, which are related to the distribution of education enterprises' control and consensus. It found 60% of use cases discuss evidence-based transactions related to student's control and consensus. Only 30% of use cases implemented some elements of assess transactions. The distribution of the selected use cases across the three analysis themes viz., *access*, *evidence*, *credential* is presented in Figure 2.

This study posits that the *assess* transactions in blockchain can be critical differentiators. They are effective in addressing the development and tracking of 21C skills for education enterprises due to three key reasons. First, establishing a blockchain-based assessment capability can enable institutions to address assessment transparency issues identified by the assuring graduate capabilities study (Oliver, 2015). Second, the *assess* chain can evidence and claim credit for developing the skills required by employers through micro-credentials (Oliver, 2019). Third, a blockchain-based skills chain provides an immutable repository of data that is transparent and controlled. Hence, subsequent analytics of this chain data can enable education enterprises to enhance their own strategic learning capabilities (Thomas et al., 2001) and initiate the reconfiguration (Teece, 2007) of their teaching capabilities, namely *specify*, *engage*, and *enhance* (Oliver, 2015).

Figure 2. Blockchain use cases in assess, evidence, and credential transactions



Considering the reduced cost of networking and verification features (Catalini & Gans, 2017) of blockchain, this study proposes the *blockchain for education learning ledger (BELL)* model for transforming learning from discrete time-bound activities to lifelong learning behaviors. Based on the content analysis of the selected use cases, this study further proposes a multi-chain model with three chains to enable the transformation of the learning processes through the *assess, evidence*, and *credential* transactions. The chains mentioned below are also relevant for all three key stakeholders, namely universities, students, and employers, for recording and tracking 21C skills. These chains also provide a foundation

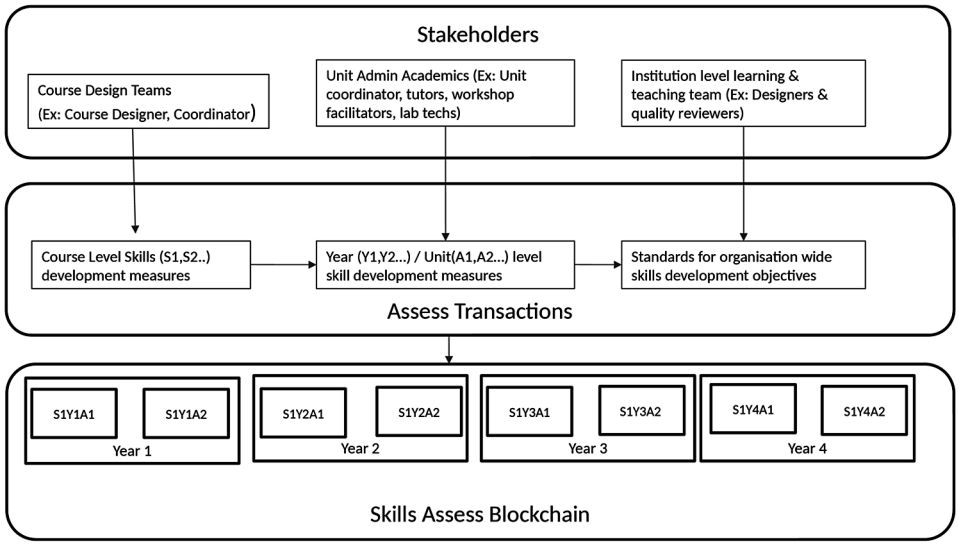
for lifelong strategic learning capabilities for individual learners. The three chains of the BELL model, namely, *assess blockchain*, *evidence blockchain*, and *credential blockchain*, are explained below.

Assess Skills Blockchain

The *assess* chain will capture the transactions related to the definition and publishing of assessments, which are commonly used methods for evaluating student learning within a particular study unit or course. Different types of exams (traditional), essays, reviews and annotated bibliographies, reports, practical work, portfolios, presentations, oral examinations, student projects, poster displays and exhibitions, dissertations and theses, work-integrated learning, and critical incident accounts are identified as discrete events related to the assessment activities in higher education (P. Race, 2019). Although there are many assessment types, the skills measured through these assessments are not explicitly reported for each student. Presently, the skills are implicit in the design of (a) course learning outcomes and (b) individual assessment structures. Hence, they are not always measured and reported explicitly and integrated as part of the assessment of knowledge.

The Assess Skills blockchain (Figure 3) provides a logical structure and foundation to transform assessment capability universities. This chain is designed to enable academics to establish and measure the 21C skills of all learners as part of their assessment process. Considering the assessment and evaluation activities, the model provides a conceptual structure for the assess chain. The logical structure and blockchain transactions are outlined in Figure 3.

Figure 3. Logical structure of the assess skills blockchain



The assessments tracked by the skills chain have the following differences compared with the traditional assessment definition and tracking. The seven values listed in Column 1 of Table 2 were selected from the methods used for improving assessments (P. Race, 2019) based on 15 different values and principles of assessment design (P. B. Race et al., 2005). Based on the improvement methods identified, this study

posits that the use of blockchain can be a single digital tool, which allows a standard approach to enhance the *assess* capabilities for educational enterprises. This provides transparency in tracking, assessing, and reporting skill development of individual learners. Thus, assessment design and implementation can be enhanced by universities through the novel use of blockchain (see Table 2)

Table 2. Transformation of assessment capability (traditional vs. assess skills blockchain)

Improvement Factors (P. Race, 2019)	Skills in Traditional Assessments	Assess Skills Blockchain
Validity	• Measures knowledge gained explicitly • Skills are implicit or • Part of well-designed criteria sheets	• Established a university-level chain for individual skills that align with the vision and values at the university level • Consensus models can enforce the validity of assessments for specific skills
Reliable	• Can be subjective based upon teaching values and philosophies of individual assessors • Mitigated by a moderation process • Limited or no organization or faculty-wide quality control procedures	• Controlling nodes (learning designers and industry standards) can be established and assigned • Based on skills that are tracked at the university, faculty, and department levels
Transparent	• Only transparent within the unit and course level • University-wide visibility is not a common practice	• Faculty and all participants across the university can have visibility • Consistency of options available for measuring, tracking, and recording skills
Diverse and useful	• 15 types with four different types of exams • Individual students may or may not be able to perform for the type selected by the teacher • The feedback is minimal (i.e., exams) or may not be customized for an individual learner • Feedback may not focus on the skills development	• Central teams can establish and manage the assessment choices based on the skills to be developed • Can allow consistent feedback methods related to the development of skills • Potential to enable a student to choose the assessment type (oral or video report or presentation) format to demonstrate their specific (communication) skills
Feedback	• Highly depended upon assessor's knowledge • Limited time availability	• Consistency of feedback mechanisms • Assure accumulated development of the target skills
Authentic	• Measures are not always individual-specific • May not reflect the actual performance • Practical implementation is not always possible	• Controlling nodes, consensus models, and smart contracts can be based on explicit knowledge • Integrative design and quality control teams can evaluate and validate authenticity • Accumulated over time across all years of study
Manageable	• Key consideration for unit administrators • Assessors time • University investments	• Standard set of criterion-referenced assessment (CRA) for skills to be deployed across all study units and courses • Measurement variations will need to be approved by consensus

Source: Authors

In conclusion, the *asssess* skills chain can be the differentiating value for universities to explicitly demonstrate how their staff, processes, and sytems enable enhanced learning and transform it from teacher-centered to student-centered within their routines. Establishing a blockchain-based assessment capability and subsequent analysis of the data will allow universities to refine the associated teaching capabilities, namely *enhance*, *specify*, and *engage* (Oliver, 2015).

Evidence Blockchain

The *evidence* chain data will be added by all students after the assessment results are in *immutable* status (i.e., published, reviewed, and accepted by students) within the course level existing governance systems. The specific transactional data (to be stored) will be decided at the course level so that the evidence can enable students to claim their 21C skills. Since this is proposed as a permissionless public chain, a student can add his own skills records gained from other education enterprises (e.g., a university student completes an industry offered certification course such as SAP and adds the associated skills to the evidence chain).

Student Submitted Assessment Items

Use cases within the sample collected for analysis document a broad range of certifications, awards, badges, and tokens, earned, and awarded to individuals of all ages. The wide scope of industries covered in this sample varies in the scope of courses from a few to many. For example, information and technology have many possible certifications and qualifications that can be earned. Existing certifications and further learning courses are offered online with examinations held at local landmarks within city precincts due to the need for supervision of exam processes. Other popular courses include TAFE (technical and further education), offering diverse courses ranging from management, healthcare, horticulture, sales, sports, and hospitality.

Resulting CRAs (Criterion-Referenced Assessments)

The sampled use cases related to criterion-based assessments indicate a greater percentage of cases that discuss and document the inclusion of this genre of assessment. The cases discuss the related evaluation and learning processes with a strong tendency towards content that is beneficial to work opportunities and leading towards recognition of prior learning. This type of assessment is focused specifically on mature learners with prior life experiences. CRAs can and do vary in the context of the unit material and focus. In many instances, the use cases show a trend whereby assessments cover materials that allow critical thinking, analytical processing, and target content that is useful to students in real-world problem-solving situations.

Smart Contracts

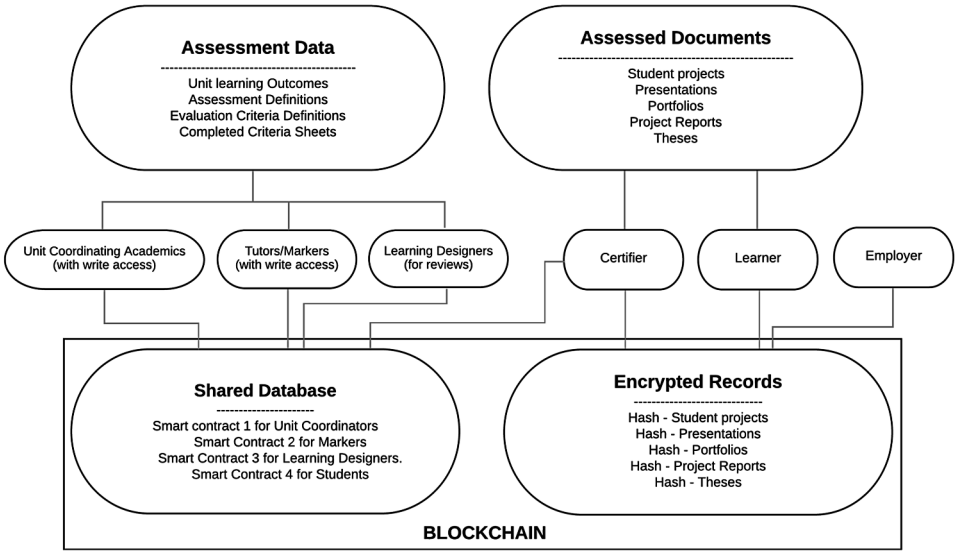
Analysis of the 20 use cases provides a snapshot of sample cases that use smart contracts. These apply to transacting data to the academic record held on the blockchain. This is in the context of data, which relates to the *evidence* artifact of an academic record. Of the 20 cases analyzed, eight cases used smart contracts for evidencing data that would be transacted to the academic record. Three cases did not use any smart contract for this purpose, and nine cases did not cover this aspect in their study.

In conclusion, the *evidence* chain subset for the sample use cases was varied and covered a diverse range of technologies, methods, and processes. A few studies did not mention this property, as it was not within the scope of their investigations. However, it can be ascertained from the analysis that within the global blockchain for education undertakings, most cases include some derivative of an *evidence* chain.

Credentials Blockchain

This chain would control nodes managed by certifiers, certification authorities, and accreditation authorities. Students and employers will be the primary users of this chain. All current use cases focus on this aspect of blockchain for the distribution of final outcomes for the learners. Blockcerts by MIT labs is one of the most suitable options for implementing credentials for any education enterprises.

Figure 4. Logical Structure for Evidence Chain



FUTURE RESEARCH DIRECTIONS

This study provides a blockchain-based model that enables both traditional universities and MOOCs to modify their assessment evaluands for capturing student's learning outcomes. The secure storage and unlimited availability of these digitized learning records are useful to both learners and businesses for addressing 21C skills and fulfilling Industry 4.0 demands. The subsequent analytics of these records can enable strategic learning for institutions to refine their teaching processes using the *enhance*, *specify*, and *engage* activities. Since blockchain is still in the early adoption phase of the innovation diffusion lifecycle (Stratopoulos et al., 2020), the consensus models for 21C skills, as well as smart contracts specifications for other use cases, can be investigated by future scholars. Considering the TIM model's (Bonfiglio-Pavisich, 2018) adoption in this study, future researchers can extend and propose blockchain-based assessment models for measuring 21C skills development for high school learners.

CONCLUSION

In conclusion, the blockchain for education learning ledger (BELL) model provides a comprehensive blockchain solution, which leverages all the blockchain features to transform the learning outcomes into

student-centric learning processes and develop 21C skills for learners, employers, and service providers. The proposed three distinct chains address the needs of three stakeholders, namely education enterprises, students, and employers. The BELL model offers new directions in terms of how education enterprises (both traditional and digital) can transform learning strategies through the novel use of blockchain (e.g., strategic learning capability using the *assess* chain). The *credentials* and *evidence* chains provide for lifelong learning of 21C skills for both digital natives as well as matured age learners. The *credentials* chain provides ease of access and automated verification of employee skills.

A comparative study of five technology pedagogy integration frameworks (Bonfiglio-Pavisich, 2018) identified a technology integration matrix (TIM) as the preferred approach for real-world skills (Harmes et al., 2016). Although TIM was proposed as the evaluation model for schools, the TIM matrix provides a holistic approach foundation for transforming into student-centered meaningful learning as well as developing real-world skills. This study concludes that blockchain can become the primary catalyst for transforming education enterprises and developing strategic learning capabilities. It can address the lifelong learning needs of digital natives as well as meet the rising demands of Industry 4.0.

ACKNOWLEDGMENT

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KEY TERMS AND DEFINITIONS

Blockchain: Blockchain is a foundational digital mechanism that offers a digitally distributed transactions journal, which can store cryptographic security enforced immutable data. It offers utility values such as digital trust, privacy, and security through public and private keys.

Digital Transformation: Digital transformation is a process triggered by emerging technologies such as blockchain and calls for strategic responses of institutions (education enterprises in this study) that seek to alter their value creation paths and thus contribute to the strategic renewal of organizations.

Education Enterprises: Education enterprises include both traditional universities and massive open online course (MOOCs) platforms offered by enterprises such as Coursera, Edx, and Futurelearn.

Strategic Learning: Strategic learning is an outcome for both organizations as well as for individuals. It is viewed as a dynamic capability at the educational institution level and a lifelong learning capability at the individual level.

Chapter 5
Innovation Leadership in the Digital Enterprise:
Lessons From Pioneers

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ABSTRACT

In this chapter, the EIL (Effective Innovation Leadership) framework is tested empirically. First, peer-reviewed journals in the innovation management, leadership, and transformation discipline are analyzed. Second, a pre-test with 58 executives takes place. The response behavior of the participants varies depending on the company's degree of digital maturity. Third, 20 innovation leaders employed in mature digital companies answer the survey. The participants perceive their company as innovative and state that up to 89% of created innovations are digital. Values relevant to digital innovation leaders are innovation, responsibility, positivity, and transparency. Relevant strengths are creativity and learning. Both strongly correlate with a few efficacy items. Decisiveness correlates with innovation strategy. Entrepreneurship, self-regulation, and culture correlate with each other. Creativity connects the value of innovation and the practice of communication. The insights from this chapter contribute to building a reliable and valid factor-based effective digital innovation leadership questionnaire in the future.

INTRODUCTION

This chapter is dealing with the topic "Innovation Leadership in the Digital Enterprise: Lessons from Pioneers." The purpose of this chapter is to provide information technology, business, and management practitioners with a robust theoretical framework that has matured within three studies. A secondary academic journal analysis describes the ecosystem of enterprises transforming into digital companies, facets of mature digital pioneering companies, and the leadership skillset needed. Differences between innovators, digital leaders, and innovation leaders are highlighted. An introduction of the Effective Innovation Leadership (EIL)-Framework occurs, which is the outcome of six years of research published in three peer-reviewed contributions. After the EIL-Questionnaire with 77 items has been presented, the

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empirical study starts to be described. The descriptive statistics from a pre-test with 58 executives and the correlation analysis in a Sample with Innovation Leadership from successful Technology Companies create up to 89% digital innovations.

This chapter provides input for innovation managers and innovation leaders on what they can do to become effective in the digital enterprise transformation. The author joins the book's target to consolidate innovative knowledge in management and digital enterprise transformation strategy. In order to fathom the subject, the author explores three perspectives. First, an explanation of the environment in which digital companies operate based on peer-reviewed scientific publications takes place. Then effective strategies for transforming into a digital company are described. Finally, there is a dive into the innovation leadership work in digital companies based on empirical studies.

The publication addresses modern problems and solutions for global business. Digital innovations are becoming increasingly important in the global struggle for the survival of companies. In order to approach this complex challenge, the three scientific disciplines, "Innovation Management and Technologies," "Leadership," and "Digital Transformation" are considered together.

BACKGROUND

It follows an examination of the dynamics of the digital revolution at the macro level. The Digital Revolution originated in 1947 and is ongoing ever since. The invention of the Internet, the rise of home computers, and the invention of the World Wide Web and Smartphones and Social Media are core drivers of global digitalization. Today 62% of the world population are cell phone subscribers, and 59% are internet users (Statista, 2020a; Statista, 2020b). Through the Internet and the movements documented in it, companies and consumers generate a wide variety of data that reflect user behavior information.

According to Moore's Law, computing power has doubled every 18 months for more than half a century. Moreover, there is no end in sight. This development has led to the fact that we now have computers capable of performing highly complex tasks. Artificial intelligence's beginnings can already be marveled at here and there, even if the decisive breakthrough in this sector is not expected until around 2045 (Brynjolfsson & McAfee, 2014).

We are on the cusp of an age of networked intelligence - an age that will produce a new economy, a new politics, and a new society. (Tapscott, 2013)

According to Tapscott (2013), humanity is currently operating in a knowledge economy less based on physical strength and more on people's mental strength. Information connects people across the globe. The combination of electronic data processing, communication, and content creates new branches of industry that make new companies necessary. In the digital economy, competition comes from all industries, national markets, and company sizes. When information is digital and networked, nobody can hide anymore. Digital pioneering companies such as Google, Apple, or PayPal disrupt already the banking and automotive industry. Competitors of tomorrow can come from anywhere.

Waller and Beswick (2020) encourage established companies to mobilize new digital tools so that managers and technologists alike can make fundamentally better business decisions. Research and managerial interest in digital transformation are burgeoning. Following the research of Hanelt et al. (2020: 20), "Digital Transformation can be best understood as continuous change that can be triggered

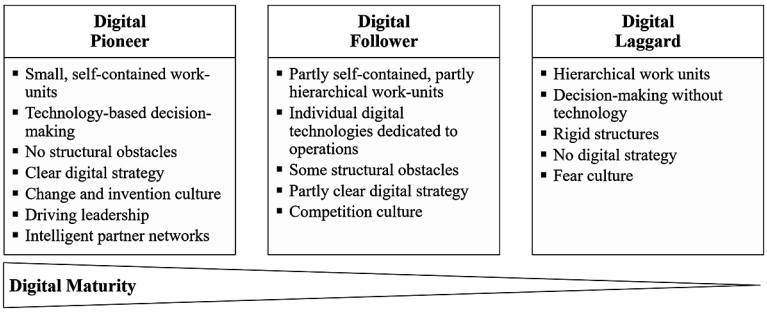
and shaped by episodic bursts, while the latter are inducing further continuous change." The scientists studied 297 articles to create this definition.

Most innovative digital enterprises that successfully transformed into a digital pioneer are leaving all the rest behind. They lead the market. Their digital engagement is very different from that of the follower or laggards such as construction, healthcare, or governments in general. Digital innovators mostly use network effects to scale. Digital market leaders are characterized by their digital strategy, skills, and culture (Manyika et al., 2016). Companies that continuously create digital innovations usually have time, quality, and cost advantages over their competitors (Power, 2016). That sounds so simple; just how does it work? According to Waller and Beswick (2020), three strategies can enable organizations to perform digital transformations that create value and enable continuous innovation. The first strategy is to remove all structural obstacles that slow the system to adapt to the market conditions. The second strategy is to adopt technology that will help to make better decisions. The third strategy is to provide small, self-contained work units. The authors encourage us to harness the increasing potential of technology to transform organizations.

Based on an MIT Sloan Management Review and Deloitte global study, mature digital enterprises are focused on integrating digital technologies following a clear digital strategy supported by leaders who, in addition to that, drive an organizational transformation towards a change and invention culture (see Figure 1). Less mature digital businesses solve business problems with individual digital technologies dedicated to operations (Kane et al., 2015). The diverse maturity levels speak for differentiation in the later empirical study. The following figure summarizes the findings of Waller and Benswick (2020), Manyika et al. (2016), Power (2016), and Kane et al. (2015) that were just discussed enriched with the author's insights.

In summary, it can be said that pioneering companies have implemented the digital transformation holistically, followers only do this in parts, and laggards use the topic of digitization in many ways only for external impact, but shy away from really initiating internal changes.

Figure 1. Digital Maturity



Primary data reveals that managerial and leadership skills are of higher importance compared to technical skills in the context of digital transformations (Gilli et al., 2020). That is why we now deduce what kind of leadership skills in digital transformation are significant. Following Westley & Mintzberg (1989) and Kotter (1990), leaders create and communicate ideas with which they authorize action by speaking of implementing visions or positioning companies for the future. The six leadership approaches most

often appearing between 2000 and 2013 as the focal theory are transformational leadership, charismatic leadership, strategic leadership, leadership and diversity, participative/shared leadership, and the trait approach to leadership (Meuser et al., 2016). Transformational leadership creates change and enhances productivity by offering a vision that attracts and inspires followers (Cambridge, 2020). Charismatic leadership suggests that leaders raise followers' aspirations and activate their higher-order values (e.g., altruism) such that followers identify with the leader and his or her mission/vision, feel better about their work, and then work to perform beyond simple transactions and base expectations (Avolio, 1999; Bass, 1985; Conger & Kanungo 1998). Strategic leadership involves learning, the capacity to change, and managerial wisdom (Boal & Hooijberg, 2000). Leadership and diversity claim to go beyond the social and cultural constraints that limit leadership. It is required that leaders should adapt to cultural contexts such as society and organization (Chin & Trimble, 2014). Participative leadership involves employees in decision-making across levels of the hierarchy (Spreitzer, 2007). Shared leadership is distributed among team members rather than focusing on a single designated leader (Carson et al., 2007). Shared leadership is "a dynamic, interactive influence process among individuals in groups for which the objective is to lead one another to the achievement of group or organizational goals or both. This influence process often involves peer, or lateral, influence and at other times involves upward or downward hierarchical influence" (Pearce & Conger, 2005: 1). Shared leadership is becoming more critical in the context of a knowledge-driven era in which firms are distributed across cultures. This insight is relevant to globally acting Technology Companies. Based on Carson et al. (2007), Avilio et al. (2009) state that future research needs to examine how team leaders affect the team's ability and motivation to be self-directed and share in leadership.

All leadership efforts in a digital enterprise are geared towards generating short-term and long-term value for customers. To achieve this, external business partners, in particular, are integrated, and technologies are seamlessly integrated (Nielsen & Meehan, 2015). The success of innovative digital enterprises often depends on the efforts of other innovators in their environment. Therefore, external partners' integration becomes a core task of leaders in a digital enterprise (Adner, & Kapoor, 2010). This insight gives the shared leadership approach a whole new meaning. Because if companies can only become successful if they act in a partner network, then shared leadership becomes a must-have skill. Moreover, if we also consider that digital companies can draw from the local area and the global environment, leadership and diversity also gain more weight.

Leaders in the digital enterprise need to manage the increased pace in the digital ecosystem. They face greater expectations of productivity. There is also a need for flexible and distributed workplaces and a shift in organizational culture. Effective leaders in the digital enterprise need to provide a vision and direction explaining the "why" of actions. They anticipate markets and trends as well as understand technology. Also, they need to adapt to change, take on responsibility for the digital transformation, and empower and enable employees to carry out new initiatives (Kane et al., 2019). The ability to recognize trends was already highlighted by Drucker (2002) as a discipline of innovation. Before technologies can be adopted, they must be understood. So, this ability makes sense in any case. Innovation involves change; it requires employees and managers who take responsibility for its development. The factors mentioned here, which are required for digital managers, are also crucial for Effective Innovation Leaders active in digital enterprises, which the author names Effective Digital Innovation Leaders (EDIL).

New leadership styles arise by integrating aspects such as complexity, shared, collective, or distributed leadership. Avilio et al. (2009) recommend that future research in digital transformation should be dealing with leadership, focusing on virtual team management incorporating motivational elements and

diversity of the group. They raise the question of "how existing leadership styles and cultures embedded in a group and organization affect the appropriation of advanced information technology systems." This requirement fits in with other experts' desire to keep an eye on trends and penetrate meaningful technologies or integrate them into decision-making processes. Above that, Avilio et al. (2009) propose to focus the attention not only on individuals neither on the complex interplay of numerous interacting forces. To do that, the researchers suggest field observations and agent-based model simulations. This requirement is reminiscent of the shared leadership concept, which enjoys a high level of attention in leadership research (Pearce & Conger, 2005; Carson et al., 2007).

Leaders in the volatile, uncertain, complex, and the ambiguous world need to face digital transformation holistically. There is a need to create new leadership approaches for digital transformation. Weber et al. (2019) propose a framework based on the competing values framework, according to Quinn et al. (1991), which includes two areas of tension, the internal and external focus and flexibility versus stability. Weber et al. (2019) replace the dimensions of flexibility and stability with relationship-orientation and task-orientation. Based on a classifying study with 42 digital transformation experts, they identify, for example, two relevant roles for the digital transformation à the digital pioneer and the innovator. Both roles are externally focused and task-oriented. The field has the explanation "Identifying needs for change and implementing innovative changes." The primary research with 859 employees shows that innovators create task-oriented outcomes if they perform innovation on the job.

On the other hand, if innovators share their knowledge, this might harm relation-oriented outcomes. Digital pioneers, on the other hand, create task-oriented outcomes if they are digitally mature. A technology overload harms task-oriented outcome. If digital pioneers commit themselves effectively, this has a positive effect on relation-oriented outcomes. To sum it up, innovators push a company's innovation capability forward and are robust in delivery, but their knowledge sharing may decrease team outcomes. Digital pioneers, on the other hand, educate their peers with their digital maturity if they are not overburdening their peers with technologies. This brand-new study shows how closely innovation and digitization are connected and should not be thought of separately.

In conclusion, it can be said that the digital revolution is affecting all industries. The faster a company manages to adapt its organizational culture, strategy, organization, and technologies accordingly, the higher the likelihood of developing a competitive advantage. Those companies that are considered digital pioneers in the market live a culture of the invention implement a digital strategy with agile and small work units that use sensible technologies to advise them on decision-making. To transform a company into a digital pioneer requires technical skills and leadership skills, and these can be described using the concepts of virtual leadership, leadership and diversity, and shared leadership. However, it is elementary to think about creating digitization and innovation together, what we will do now with the EIL-Framework application in pioneering digital companies.

THEORETICAL FRAMEWORK

Let us start with the definition of the most important terms. What is Effective Innovation Leadership? The term emerged during the author's Ph.D. study and is still unique. The innovation leadership movement is gaining attention in the context of digital transformation and the globalized world economy since 2002: Murphy & Murphy (2002), Bossink (2004), Gliddon (2006), Carmeli et al. (2010), Hunter & Cushenbery (2011), Rosing et al. (2011), O'Reilly and Tushman (2013), Kaudela-Baum et al. (2014),

Gliddon (2018). The variety of innovation leadership definitions is aggregated in the publication Schork (2020). In this chapter, the core definition that has arisen from it is given. Innovation leaders are opinion leaders who secure a company's economic success by promoting, initiating and controlling innovations. They research and implement innovations and therefore manage processes and people.

Digital innovations can be defined as the "creation of (and the consequent change in) market offerings, business processes, or models that result from the use of digital technologies" so that "digital innovation management refers to the practices, processes, and principles that underlie the effective orchestration of digital innovation" (Nambisan et al., 2017: 224). Digitalized products, services, or processes are examples of digital innovations in the market.

Effective Innovation Leaders (EIL) in the digital enterprise transform unique ideas and affordable technologies into marketable digital innovations. In this chapter, we call them Effective Digital Innovation Leaders (EDIL). Those digital innovations create value globally. Sustainable acting EDILs create digital innovations that give something back to society, economy, or ecology without taking something away. Ethically acting EDILs think about the consequences of their actions and proactively handle the societal, ecological, and economic effects of their engagements.

In order to be able to develop innovations, managers have to get their employees behind them. They can do this through charismatic leadership. Innovations can only be successful when a network consists of different partners, so the shared leadership concept is of particular importance. Also, researchers have already recognized that the innovative capacity of teams correlates with increasing diversity and that EDILs must therefore be able to manage diversity. The discipline of innovation is about integrating diversity that rubs against each other to develop innovations that create value by covering an unmet need in society through a new idea or technology (MIT OpenCourse, 2013). Diversity is, therefore, also part of digital innovation leadership. Innovations are improvements of the existing without claiming uniqueness or intelligence (Potts, 1944). Change comes through innovations, and trends are the basis of innovations. So basically, all the mentioned leadership skills that apply to the new era are needed. Innovation manages to allow contradictions to exist side by side and use it as a source of ideas (Drucker, 2002 & Hill et al., 2014). The leadership of complexity has its place in digital innovation leadership. EDILs operate in an entrepreneurial environment. To take effect, we assume that they make the digital pioneer companies' conditions even more useful. How exactly, we look at that in a primary data collection.

Before we turn to this chapter's primary data collection, let us provide an insight into the EIL-Framework, which has gone through three stages of development over the past six years. As Table 1 shows, the EIL-Framework resulted from a grounded theory analysis in which five different data sources were iterated. The focus of the grounded theory analysis was the ICT-industry. Two of the four subcategories were quantitatively assessed in an ICT-study with 96 participants. The analysis showed diverse positive and significant correlations. Most importantly, the practices of entrepreneurship and focus have a significant positive effect on business success. Since the categories of the three subcategories values, strengths, and practices were based on a secondary data foundation, a field study was carried out with three executives in digital business units. Based on the data collected in it, enriched by literature analysis, the constructs were concretized practically. The in-field result is that, in particular, the values of openness and trust must be lived in the digital company so that digital innovations can arise. EILs are particularly strong in association (now: creativity), delivery, and perseverance (now: persuasiveness). They practice focus and entrepreneurship, which is in line with the findings of the first study.

Table 1. EIL-Framework Development Stages

Framework Version	EIL 1.0	EIL 2.0	EIL 3.0
Study Duration	2014-2016	2016-2017	2018-2019
∑ Participants	178	3	1
Research Steps	1. Literature Review Timely leadership theories 2. Qualitative Study Group discussion (N=10) Narrative interviews (N=14) Open questionnaire (N=25) Three case studies (N=33) 3. Item Development Document analysis (N=50) 4. Content Validity Correlation analysis (N=96)	1. Literature Review Concretization of the sub categories descriptions 2. Qualitative Study Three innovation leaders in digital business units 3. Item Development Description of the constructs based on field data	1. Literature Review Deepen existing innovation leadership definitions 2. Item development Operationalization of sub category definitions 3. Qualitative Study Comparison of the EIL-Framework with entrepreneurial leadership, effectuation, and social entrepreneurial leadership
Core Category	Efficacy		
Sub Categories (Constructs)	Values (7), Strengths (6), Practices (7), Success (5)	Values (2), Strengths (3), Practices (2)	Values (7), Strengths (6), Practices (7)
Key Insights	Innovation culture, organization, strategy, and technology are important to create an innovative digital business. The practices focus, cooperation, reflexivity, and entrepreneurship have a significant positive effect on innovation teams‘ professionalism. Innovation teams well-being positively correlates significantly with cooperation, context support, and entrepreneurship. The practices focus and entrepreneurship positively affect business performance.	The two values openness and trust are highly relevant for the effectiveness of innovation leaders in digital business units. Both values have an impact on the willingness and drive of employees to innovate. Effective innovation leaders are especially strong in association, delivery, and perseverance. Effective innovation leaders practice focus and entrepreneurship. Ineffective innovation leaders tend to be egoistic, fixed to their convictions, and inflexible. They live conditional trust, are judgmental and are unable to deliver innovations in a focused manner.	Innovation leadership is an individual task that is embedded within the innovation strategy of an enterprise. Unique for innovation leaders is the value transparency, and the practice reflexivity. They need to be strong in creativity, and therefore adapt resisting systems, such power and performance systems. Innovation leaders need decision spaces. They can only be effective with engaged open-minded and flexible team members. Ego, inflexible or fixed mindsets hinder innovation.
Publication	Schork, 2017	Schork, 2018	Schork, 2020

Source: (own representation, 2020)

To align the EIL-Framework's question batteries more closely with existing research on innovation leaders, an in-depth analysis of the existing definitions of innovation leadership was carried out. Each construct of the subcategory's values, strengths, and practices was broken down into a five-dimensional battery of questions. Also, the EIL-Framework was compared with recognized existing management models from the entrepreneurship discipline. It becomes clear that innovation leaders can only affect if the business environment allows them by comparing the theories. In particular, areas of responsibility play a significant role here, mainly influenced by power and performance systems. Hierarchies and fixed attitudes, as well as egos, can prevent the effectiveness of innovation leaders. EILs often have to enable creativity and thus work with existing systems. Innovation leaders can become effective with a team composed of open-minded and flexible people. Rigidity and compulsion hinder innovation.

The core findings from the three publications just presented are now summarized:

- The value openness positively affects the effectiveness of Innovation Leaders [ILs].
- The value transparency positively affects the effectiveness of ILs.
- The strength association (now: creativity) positively affects the effectiveness of ILs.

- The strength delivery positively affects the effectiveness of ILs.
- The strength perseverance (now: persuasiveness) positively affects the effectiveness of ILs.
- The practice reflexivity positively affects the effectiveness of the effectiveness of ILs.
- The practice entrepreneurship positively affects the effectiveness of ILs.
- The practice focus positively affects the effectiveness of ILs.

Diverse organizational context factors influence a team and company's innovation performance and, therefore, the effectiveness of digital companies' innovation leaders. The most important relationships identified in peer-reviewed scientific papers are aggregated in the following:

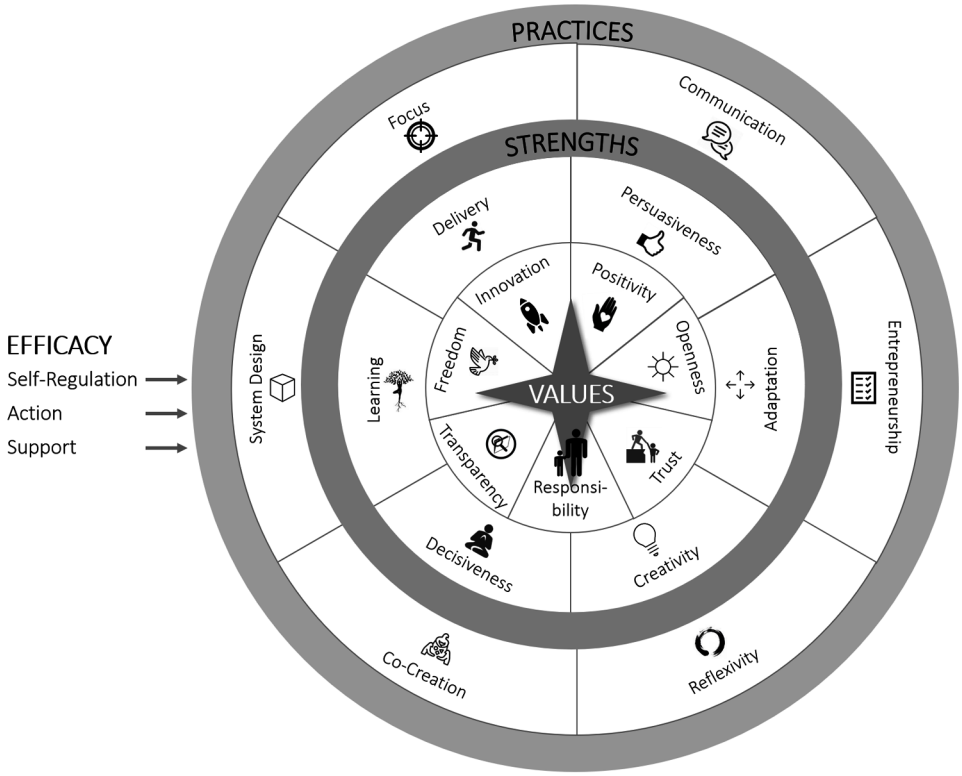
- The composition or creative innovation teams affects the innovation performance (Dlugoborskytė et al., 2015).
- Organizational structure affects innovation performance (Dedahanov et al., 2017).
- The organizational culture affects innovation performance (Hogan & Coote, 2014).
- The organizational culture factors are positively affecting innovative capacity (Chih et al., 2011).
- The absorptive capacity of an organization positively affects innovation performance (Chih et al., 2011).
- Innovation team climate and team performance are linked (Valls et al., 2016; Bain et al., 2001).
- The innovation strategy affects innovation performance (Wu & Lin, 2011).
- Innovation strategy and specific elements of organizational culture are interrelated (Chen et al., 2018).

Now let us take a closer look at the composition of the EIL-Framework 4.0. It consists of the core category "Efficacy," which drives the three categories "Values, Strengths, and Practices" broken down into nineteen constructs. Figure 2 shows the seven values, six strengths, and six practices.

In order to better understand each construct, Table 2 summarizes the definition per construct at the meta-level. The definitions are based on the outcomes of the three publications Schork (2017: 192-193), Schork (2018), and Schork (2020: 8-10), in which the definitions were derived from various sources and peer-reviewed journals. As well, Table 2 shows how the EIL-Framework in this study was expanded. Since the core category of effectiveness has only been defined but not operationalized, this will take place in this book's contribution. A battery of questions that have been adequately tested for reliability and validity is used. The survey was developed and researched by Hannah and Avilio (2013). The effectiveness is made up of three constructs of self-regulation, action, and support. Each of which is asked with seven to eight questions. Contrary to the scientists' recommendation, the author uses a six-point-Likert-scale to all EIL-questions in the same way.

The EIL-Questionnaire contains a battery of seventy-seven questions about the leadership values and behaviors (including question batteries by Hannah et al. 2012 & Hannah et al. 2008), twelve questions about the organization, and five questions about the participant's demography. Most of the questions are queried using a six-point Likert scale (99: I do not know, 1: Not applicable at all; 2: Not applicable; 3: Less applicable, 4: Rather applicable, 5: Applicable, 6: Very applicable).

Figure 2. EIL-Framework 4.0



DESCRIPTIVE STATISTICS

Is the newly created EIL-Framework stable? The author examines this in the following pre-study. Therefore, executives within a German management association fill out the online EIL-Questionnaire in April 2020. As a result, fifty-eight executives from different companies and industries participate. With 43% of women and 57% men, we recognize a balanced gender mix. A heterogeneous population was deliberately chosen to check the question batteries' stability and differences in response behavior. Fifty participants indicate their age, which varies from 31 to 74. The leadership experience ranges from a few months to forty years. The executives rate the innovative ability of their company very differently. The range from 'not applicable at all' to 'very applicable' is exhausted. The average value of enterprise innovation capability is 3,6. The value stands for less to relatively applicable.

Cronbach's Alpha [CA] on the construct level shows internal consistency. The CA is the most well-known measure of the scale reliability in quantitative surveys (Leedy & Ormrod, 2013). CA assumes that all factor loadings are equal. In reality, this is seldom the case. With this, CA systematically underestimates the reliability. The Cronbach's Alpha can be measured using the following formula:

$$\propto = \frac{N^2 \overline{\text{cov}}}{\sqrt{\sum s^2_{item} + \sum \text{cov}_{item}}} \tag{1}$$

Table 2. EIL-Framework Definitions

Category	Dimension	Definition	Number of Questions	Scale
Values	Freedom	Make decisions free from specific personal or social ties	1	6-Point-Likert, including no information
	Innovation	Create something new	1	
	Openness	Perceive situations without judgment	1	
	Positivity	Assume that life and people mean well with us	1	
	Responsibility	Take personal responsibility for innovations	1	
	Transparency	Make actions visible and comprehensible	1	
	Trust	Trust people unconditionally	1	
Strengths	Adaptation	Adapt to changes (i.e., needs, technology, processes, circumstances)	4	
	Creativity	Solve problems in original ways	4	
	Delivery	Disciplined implementation of tasks	4	
	Decisiveness	Independent, calm decision making	4	
	Learning	Intrinsic lifelong learning	4	
	Persuasiveness	Convincing others	4	
Practices	Communication	Creating common sense with sufficient communication	4	
	Co-Creation	Joint development of solutions	4	
	Entrepreneurship	Implementation of competitive ideas in the market	4	
	Focus	Focus on desirable, feasible and profitable initiatives	4	
	Reflexivity	Evaluation of diverse perspectives	4	
	System Design	Creating an agile working setting	4	
Efficacy	Self-Regulation	Think through complex situations and motivate oneself to enact solutions	7	
	Action	Effectively execute by motivating, coaching and inspiring followers	8	
	Support	Draw upon own work environment to enhance leadership	8	

$\overline{\text{cov}}$ = average covariance between items;
N^2 = number of elements in the square
s^2_{item} = Item variances;
cov_{item} = Item covariances

The variance is the squared deviation from the mean. Furthermore, covariance is a non-standardized measure of relationship that is used to describe linear relationships.

Since the values are only queried with an item, no CA value is measured for this. Brosius (2013: 826) requires a minimum CA value of .7. Only the constructs' learning' with .765 and 'action' with .748 achieve this required minimum value. It looks different if only those executive profiles which indicate

that their organization is (very) innovative (n=14) or those executive profiles that indicate that their organization is not innovative (at all; n=8) are examined (see Table 3). In both subgroups, the construct's learning is stable with a CA >.7. In the executives who state that they work in an innovative company, communication, entrepreneurship, and action have a CA value >.7. The executives who state that they work in a non-innovative company, the constructs decisiveness, persuasiveness, co-creation, focus, and support have a CA value >.7.

Table 3. Cronbach's Alpha in the Pre-Test Sample

Category	Dimension	CA, n=58	CA, n=14	CA, n=8
Strengths	Adaptation	-.061	.604	-.030
	Creativity	.463, excl. C1	.536	.649
	Delivery	.389, excl. D1	.521	-.536, excl. D3
	Decisiveness	.481, excl. D2	.007	**.760, excl. D2**
	Learning	**.765**	**.752**	**.829**
	Persuasiveness	.643, excl. P2	.012	**.781**
Practices	Communication	-.059	**.825, excl. C4**	-.269
	Co-Creation	-.072	.599, excl. CC2	**.782, excl. CC2**
	Entrepreneurship	-.112	**.846**	.309
	Focus	.629	.004	**.800**
	Reflexivity	-.093	-.674, excl. R1	**.757, excl. R1**
	System Design	.296, excl. SD3	.690, excl. SD3	.396
Efficacy	Self-Regulation	.485, excl. SR8	.667, excl. S8	.394
	Action	.748	**.848**	.612
	Support	.485, excl. S6	.603, excl. S3	**.776**

Table 4. Overview of the Digital Pioneer Sample

Company	Industry	Participants	Origin	Employees
A	Technology	12	USA	40.000
B	Technology	8	Germany	100.000

The author takes a closer look at the profiles of innovation leaders working within two successful digital enterprises. The digital enterprise sample was carried out between May and June 2020. Company A is headquartered in the U.S. and employs around 40.000 people. Company B is headquartered in Germany and employs around 100.000 people. Twelve DILs from company A and eight DILs from company B participate in the study (see Table 4). All digital innovation leaders are working in German-speaking markets. All twenty participants state that their company is innovative (Median: 5.00, Mean: 4.75). The participants of company A are aged between 40 and 58 and are all male. They state that their

company produces 89% digital innovations. The participants of company B are aged between 23 and 52. Half of the participants are male and half female. They state that their company produces 86% digital innovations. Since both companies are classified as innovative and mainly produce digital innovation, they are referred to as digital pioneers.

Table 5 aggregates the CA values generated in the Digital Pioneer Sample. The strength persuasiveness and the efficacy construct support show a CA > .7 in the complete Digital Pioneer Sample and the two company subgroups. The strength creativity and the two practices communication and co-creation show a CA > .7 in the combined sample. Since this result does not show in the split-up subgroups, stable constructs are not assumed.

Table 5. Cronbach's Alpha in the Digital Pioneer Sample

Category	Dimension	CA, Digital Pioneers	CA, Company A	CA, Company B
Strengths	Adaptation	.319	.487	.256
	Creativity	*.768, excl. C1*	.632	.615 (.821, excl. C1)
	Delivery	.408	.652	-.208
	Decisiveness	.545, excl. D3	.568, excl. D3	.687, excl. D3
	Learning	.545	.234	-.356
	Persuasiveness	**.806, excl. P4**	**.721, excl. P4**	**.889, excl. P4**
Practices	*Communication*	*.706, excl. C4*	.607	-.273
	Co-Creation	*.746, excl. CC1*	.695, excl. CC1	.554, excl. CC1
	Entrepreneurship	.312	.638	.415
	Focus	.280	.244	-1.44
	Reflexivity	.687, excl. R3	**.831, excl. R3**	.607, excl. R3
	System Design	.497	.602, excl. SD3	**.775, excl. SD2**
Efficacy	Action	.352	.445	.321
	Self-Regulation	.326	.631, excl. SR7	.545, excl. SR1
	Support	**.843**	**.729**	**.921**

The two samples' very different results conclude that the question-batteries need to be improved to measure the same thing, no matter in which sample they are used. The following analyzes are carried out at the item level.

The standard deviation is a measure of dispersion in descriptive statistics, which measures the "mean deviation from the mean." Francis Galton introduced it in 1860 (Cleff, 2008: 59-60). The standard deviation (s) is calculated from the square root of the variance.

The formula for the standard deviation [SD] is as follows (Homburg et al., 2008b: 220):

$$s = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}\left(x_i - \overline{x}\right)^2} \tag{2}$$

Table 6. Overview of the Digital Pioneers Sample

Value	Mean		Standard Error // Mean		Standard Deviation	
	Company A	**Company B**	**Company A**	**Company B**	**Company A**	**Company B**
Innovation	**5.17**	**5.38**	.21	.38	.72	1.10
Openness	**5.33**	**5.25**	.22	.31	.78	.89
Positivity	4.33	4.88	.38	.13	**1.30**	.35
Trust	4.25	4.71	.39	.36	**1.36**	
Responsibility	5.58	4.75	.15	.56	.52	1.58
Transparency	**5.67**	**5.75**	.14	.16	.50	.46
Freedom	4.50	5.13	.42	.40	**1.45**	**1.13**

x_i = value of the participant;
$\overline{x}$ = group mean;
n = sample size

Deviations from the average are weighted more heavily by squaring x_i - $\overline{x}$. The group mean ($\overline{x}$) is the sum of the observed values x_i divided by the number n of observations (Field 2013: 23):

$$\overline{x} = \frac{1}{n}\sum_{i=1}^{n} x_i \tag{3}$$

x_i = value of the participant;
$\overline{x}$ = group mean;
n = sample size

The group mean ($\overline{x}$) is the sum of the observed values x_i divided by the number n of observations (Field 2013: 23):

$$\overline{x} = \frac{1}{n}\sum_{i=1}^{n} x_i \tag{4}$$

x_i = value of the participant;
$\overline{x}$ = group mean;
n = sample size

Table 6 shows that both companies' digital innovation leaders value innovation, openness, and transparency the most and disagree on classifying the value of freedom (see Standard Deviation >1.0). The participants of company A value responsibility higher and freedom lower than the participants of

company B. The participants of company A disagree regarding the values of positivity and trust (Standard Deviation >1.0). The standard error of the mean value is relatively small (see columns 4 and 5).

What do executives from the pre-test value? A comparison is made between the participants who rate their company as innovative (n=14), who rate their company as moderately innovative (n=36), and those who rate their company as not innovative (n=8). Table 7 shows that the Pre-test sample rates innovation, responsibility, and transparency as the most important. Unlike the digital pioneers, the executives from the pre-test value less strongly openness and more strongly responsibility. The pre-test sample disagrees about the values of openness, positivity, trust, and freedom (Standard Deviation >1.0).

Table 7. Overview of the Pre-Test Sample

	Mean			Standard Error // Mean			Standard Deviation		
Value	**Low**	**Med**	**High**	**Low**	**Med**	**High**	**Low**	**Med**	**High**
Innovation	**5**	**5.13**	**5.07**	.33	.14	.29	.93	.86	1.07
Openness	4.37	4.02	4.0	.50	.23	.32	**1.4**	**1.4**	**1.15**
Positivity	4.62	4.54	4.5	.50	.14	.34	**1.4**	.85	**1.29**
Trust	4.62	4.16	4.42	.57	.18	.42	**1.6**	**1.1**	**1.55**
Responsibility	**5.5**	**5.21**	**5.42**	.19	.13	.23	.53	.79	.85
Transparency	**5.75**	**5.19**	**5.29**	.25	.12	.16	.71	.7	.61
Freedom	4.38	4.17	4.92	.18	.23	.42	.52	**1.36**	**1.50**

CORRELATION ANALYSIS

Since only a few of the 77 EIL-Questionnaire items are normally distributed, only 42 moderate deviation and all question batteries are interval scaled, and therefore metric, a correlation analysis according to Pearson is carried out first. The correlation analysis does not require a normal distribution as a pre-requisite. The range of the Pearson correlation coefficient is limited to -1 to +1. The correlation coefficient is a measure of the degree of common variation of the two variables x and y (Homburg et al. 2008a: 223) and is calculated from the covariance of two variables.

The covariance of x and y (S_{xy}) is divided by the multiplied standard deviation of x and y (Cleff 2008: 110):

$$r = \frac{s_{xy}}{s_x s_y} = \frac{\frac{1}{n}\sum_{i=1}^{n}\left(x_i - \overline{x}\right)\left(y_i - \overline{y}\right)}{\sqrt{\left(\frac{1}{n}\sum_{i=1}^{n}\left(x_i - \overline{x}\right)^2\right)\left(\frac{1}{n}\sum_{i=1}^{n}\left(y_i - \overline{y}\right)^2\right)}} \; mit -1 \leq r \leq +1 \qquad (5)$$

s = covariance;
n = size of sample (x_i , y_i);
(i = 1,…,n) value pairs;

$\overline{x}$ = sample mean of all measures of the variable x;
$\overline{y}$ = sample mean of all measures of the variable y

Positive values of the correlation coefficient show a similarly directed relationship between two variables (the larger x, the larger y), negative values show an opposite relationship (the smaller x, the smaller y). There are different scientific aids to interpret the Pearson correlation coefficient. The most common is the classification by Brosius (2013: 523). It says that a correlation coefficient greater than .6 indicates a strong correlation. These correlations between metrically scaled items are now considered per sub category. Figure 3 summarizes strong significant correlations between values, strengths, and practices within the digital pioneer sample (**. The correlation is significant at the level of 0.01 (2-sided)). The values of a digital innovation leader show significant correlations with strengths (white boxes) and practices (light grey boxes) in the survey, but not with aspects of effectiveness, other values or organizational aspects. The four correlating values are innovation, positivity, responsibility, and transparency.

Figure 3. Pearson Correlation Coefficients - Values

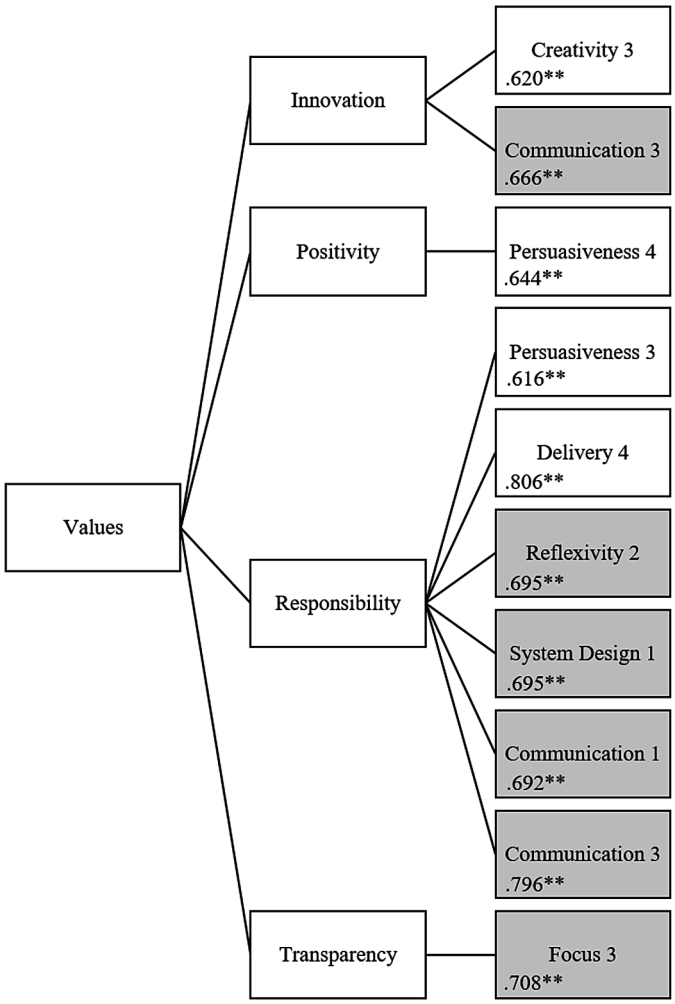
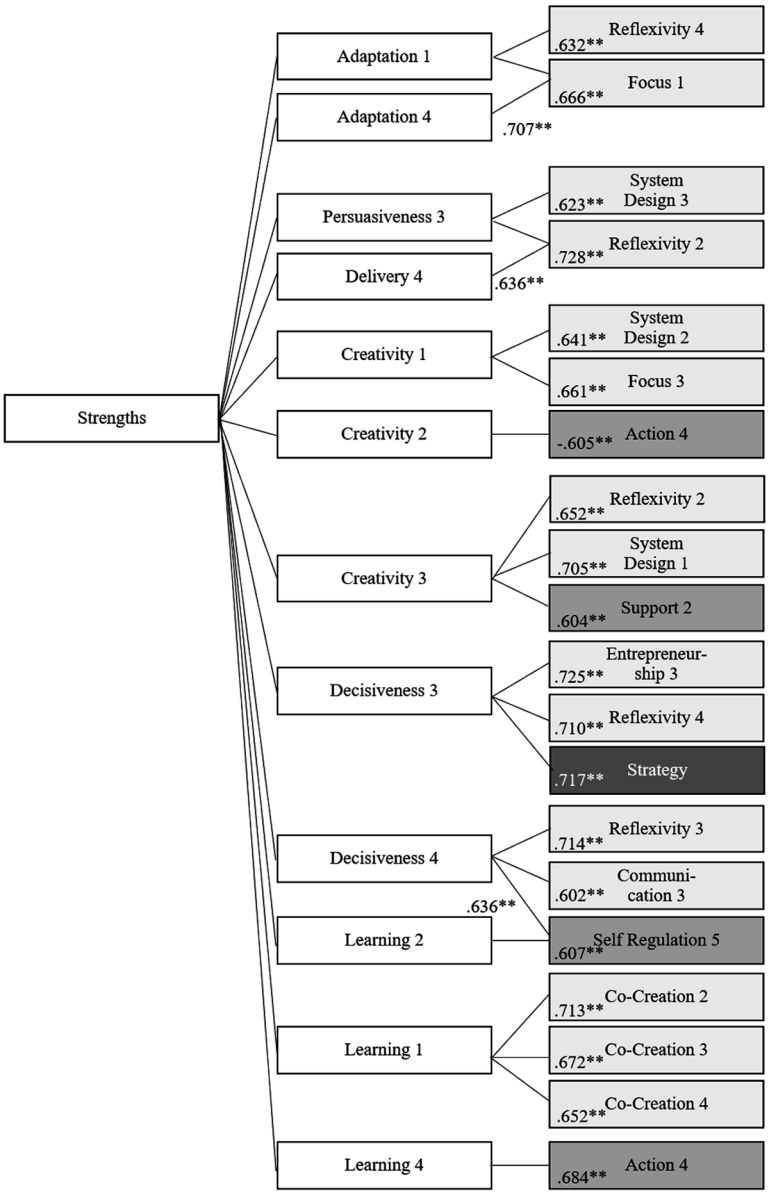


Figure 4. Pearson Correlation Coefficients - Strengths



The correlations of the items that query strengths are now considered in Figure 4. Items from all six strengths (white boxes) are correlating with items of all six practices (light grey boxes) and with items of all three effectiveness measurements (grey boxes). One item of decisiveness is correlating innovation strategy which is part of the organizational context (dark grey boxes). Three items are correlating each of learning and creativity as well as co-creation, system design, and reflexivity. Two items each correlate of adaptation, decisiveness, and focus. One item each correlates from persuasiveness, delivery, action, self-regulation, support, and entrepreneurship. The practice entrepreneurship 4 (striving to find competitive ideas) is positively correlating with self-regulation 3 (.826**) and innovation-friendly organizational

culture (.717**). Reflexivity 3 (openly challenging the perspectives of others) is negatively correlating with an existent innovation strategy (-.734**). Self-regulation 3 (adapting to the real customer perceptions) is positively correlating with an innovation-friendly organizational culture (.638**).

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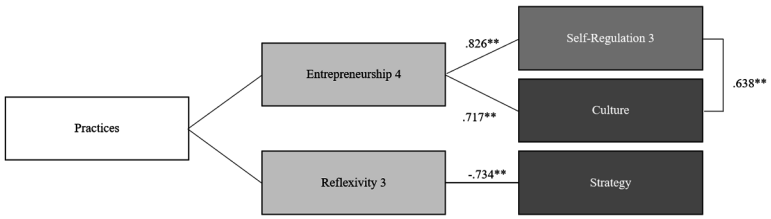
Figure 5. Pearson Correlation Coefficients - Practices



SOLUTIONS AND RECOMMENDATIONS

Based on the secondary data collection, the following findings can be summarized. Companies named as digital pioneers make technology-based decisions. They work in small self-contained work-units, follow a digital strategy, and live a change and invention culture driven by leadership. The faster a digital enterprise adapts its organizational structure, culture, strategy, and technologies to the surrounding, the higher the likelihood of staying competitive. Leaders in the digital enterprise need to manage the increased pace in the digital ecosystem. They face greater expectations of productivity. Leadership skills are more important than technical skills. Leadership styles discussed between 2000-2013 were transformational, charismatic, strategic, diverse, participative, and trait. In a digital transformation, leaders want to create customer value. Success in the digital ecosystem depends on partner integration or cooperation. That is why distributed, collective or shared leadership in the context of intelligent networks is gaining attention. Innovation leaders are opinion leaders securing the success of a company. Effective Innovation Leaders transform unique ideas and affordable technologies into marketable digital innovations with which they give in a sustainable sense something back to society, economy, and or ecology without taking anything away. Innovation leaders can only become effective if the performance and power system allows them to be responsible for innovation. Effective innovation leaders have a team consisting of open and flexible minds, not egos with fixed mindsets following hierarchies. Digital Innovation Leaders explain the "why" behind their decisions, anticipate trends, and understand when technology makes sense to support decision-making processes.

This chapter's primary data collection aim was to determine which values, strengths, and practices are actively lived by innovation leaders in digital companies. Because both technology companies were rated as innovative by the participants and are developing up to 89% digital innovations, the author named them digital pioneers. In the Pre-Test Sample, differences in executives' response behavior from more

and less mature digital companies could already be identified. The core findings of the Digital Pioneer Sample are now summarized. Digital innovation leaders value innovation, responsibility, openness, and transparency. The four values correlate with items from the practices and strengths -> however, not with an efficiacy or the organizational environment's effectiveness. The constructs of creativity, learning, system design, co-creation, and reflectivity show strongly significant correlations. The value of openness distinguishes innovation leaders from classic executives. There is disagreement about the value of freedom in the Digital Pioneer Sample. Moreover, there is disagreement about the values of positivity, trust, and openness in the Pre-Test Sample. The hypothesis that entrepreneurship as a practice, and the strength of creativity positively affects the effectiveness of DIL is confirmed in this study. No significant direct correlation of values on the effectiveness of DILs can be demonstrated. However, indirect effects via the mediator creativity are possible (Innovation => Creativity 3 => Support 2). The triangle effect of the practice entrepreneurship 4, the efficacy item self-regulation three, and innovation culture are exciting. The triangle effect of the value innovation, the strength creativity 3, and the practice communication 3 is fascinating. Creativity (support 2 and action 4) and learning (self-regulation 5 and action 4) have two connections to the efficacy of DILs. The practice reflexivity directly connects to the innovation strategy and five different strengths (adaptation, persuasiveness, delivery, creativity, and decisiveness).

A few EIL-Questionnaire optimizations have already been identified but still have to be subjected to further investigations. E.g., some aspects of the system design-construct can also be located in an organizational context. Items that correlate with one another from different constructs could be combined to form a new one. The two values, freedom and trust, could be excluded from the future EDIL-Survey. Two strengths could be added, such as technology-based decision making and recognizing trends. One practice could be added, which includes explaining why behind activities.

It can be seen that the effectiveness of innovation leaders in digital companies correlate in particular with their strengths. In the digital innovation context, the values of innovation, positivity, responsibility, and transparency seem to be particularly important. Since only four items of the three different efficiency constructs correlate in the collected sample, a separate survey and analysis is carried out to determine which construct combinations provide statistically relevant results. It cannot be denied that the EIL-Questionnaire is still in its infancy and will continue to develop in subsequent studies. Some items from system design will be examined in combination with the organizational context, and the triangle effects will also be examined more closely.

FUTURE RESEARCH DIRECTIONS

Due to the small sample size, it is recommended to test the EIL-Questionnaire validity and reliability in a larger digital pioneers' population and rename it then into EDIL-Questionnaire. The items should be adjusted so that the highly correlated ones are further preserved and expanded so that factors with high KMO measures are stable in different samples. Factor analyses and regression analyses could be carried out on a broad basis as soon as stable factors exist. The aim should be to shorten the EDIL-Questionnaire if possible, thus filtering out the most meaningful values, practices, and strengths or working out differences between digital companies' degrees of maturity. A few suggestions have already been made in the previous paragraph (excluding the values freedom and trust, integrating two new strengths and one practice).

Thought could also be given to expanding the individual perspective of an innovation leader with peer perspectives or achieved performance metrics so that the assessments have a 360-degree character. Field studies could enrich the individual perspectives of enterprise members with a more objective second-order perspective of scientists. Findings made in the field could then be further developed in agent-based model simulations.

Furthermore, the three leadership styles, shared leadership, leadership, leadership, and diversity, should be considered when researching digital companies' innovation activities. As well, networked intelligence is a topic that should be deepened.

Further EDIL research should investigate differences between more and less mature digital companies.

CONCLUSION

The brand-new secondary data lead to new insights into digital companies' characteristics or transformations towards digital companies. Digital pioneering companies are characterized by an innovative corporate environment (clear digital strategy, change and invention culture, no structural obstacles, technology-based decision making, and small, self-contained work units) and a high proportion of developed digital innovations.

New leadership models from Innovation Management & Technology and leadership research bring additional perspectives for the EIL-Framework 4.0, which should be expanded to include new aspects in the future. The application of the EIL-Framework in digital companies leads to a renaming of the EDIL-Framework.

The pre-test within the empirical study reveals that digital companies' degree of maturity influences participants' response behavior. The Digital Pioneer Sample shows that innovation, responsibility, responsibility, and positivity are essential to DILs. These are strong in creativity and learning and employ reflexivity, communication, environmental design, and entrepreneurship. DIL's behaviors correlate highly significantly with the innovation culture and the innovation strategy.

Only constructs learning, support, and persuasiveness show a high CA value. This is not enough for a stable questionnaire, which is why time should be invested in the development of stable factors in the future. Three items each within the pre-defined constructs creativity and learning correlate strongly. The constructs in which only two items were correlated should be expanded further, and the individual correlating items should be combined to form new constructs.

This contribution has brought together findings from innovation management & technology, and leadership and organization research worked out new findings from them and made suggestions on how these can be merged into the existing EIL-Framework to form a new EDIL-Framework. There is also a clear recommendation to continue the empirical research in a larger sample to work out apparent factors that can be used in diverse global technology companies. Leadership theories on diversity, shared leadership, and aspects of networked intelligence, should be integrated.

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Chapter 6
Quadruple Change:
Cultivating Digital Transformation Agent

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ABSTRACT

The author in this study presents the new term called "Quadruple Change" as a framework for delivering high-value digital transformation in organizations. The quadruple change consists of technical, organizational, social, and global change during digital transformation. The author conducted a qualitative exploratory study to explore strategies that leaders need to adopt to cultivate transformation agents during digital transformation toward establishing sustainability. The study revealed that for successful digital transformation, organizations need to empower employees, engage them in the process of change, and develop the culture of transformation in the dynamic environment. Toward this achievement, cultivating transformation agents based on quadruple change is one of the significant steps. The study findings identified seven factors contributing to cultivating transformation agents in organizations, including vision creation, mindset change, knowledge improvement, innovation development, motivation increment, leadership support, and collaboration.

INTRODUCTION

This chapter presented the concept of Quadruple Change as a framework of cultivating agents of transformation. An overview of the quadruple change in four dimensions was articulated: technical change, organizational change, social change, and global change. It elaborated on the importance of cultivating transformation agents toward establishing sustainable effectiveness organizations. The objectives of this chapter were to create a new perspective in digital transformation by presenting two new terms: quadruple change and transformation agent.

Digital transformation is a process of adopting and adapting digital technologies to augment existing services and optimize operations (Savić, 2019). Digital transformation has become increasingly important over the 21st century. In this everchanging era, all organizations endeavor to develop their digital

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strategies to make them more effective and efficient within the modern organization landscape (Ghafari, 2019; Schwamm, 2014), resulting in quality improvement, cost-effectiveness, and accessibility (Shah & Course, 2018). However, digital transformation is not solely about digitalization and digital technology implementation to create a new business model, but also about people and their mindset to accept and embrace digital changes (Tabrizi, Lam, Girard, & Irvin, 2019). Ziadlou (2020) stated that five factors in digital transformation contribute to building a smart organization, including people, technology, change, leadership, and globalization. Likewise, Becker (2014) pointed out, "Human beings can design their future by structuring the uncertain scenarios and use them as mental tools to anticipate consequences of different courses of action and then select activities that appear to lead to our desired state or goal" (p. 145). Yet, according to Ghafari (2019), Boskovic, Primorac, and Kozina (2019), Matthews (2017), and Evans (2017), organizations often struggle to maintain digital strategies because of lack of leadership skills; this issue has caused leaders to poorly forecast the trend of digital technologies or prepare their employees and their organizations for the future changes. Reis et al. (2018) described the digital transformation in three dimensions: technical, organizational, social change. The author added one more important angle in Reis et al. statement that is a global change and created a new term of Quadruple Change that must be considered in digital enterprise transformation. While modern and post-modern organizations are the systems that shift themselves from a command control system to a highly involved organization toward sustainable effectiveness organization, it is essential to consolidate these four dimensions to achieve effective outcomes. The sustainable effectiveness organization creates value for individuals, communities, and the environment besides economic return (Albers Mohrman & Edward, 2014).

BACKGROUND

Fitzgerald et al. (2014) quoted the statement of George Westermann, a Principal Research Scientist from MIT Sloan, "The big difference between the companies that are just doing technology initiatives and the companies that are leading a technology-based transformation is how they are putting the leadership frameworks in place" (p. 7). Indeed, the approach of managing the changes and embracing transformation created a new realm in leadership that induces leaders to contemplate how to lead digital transformation (Mbanaja, 2016; Schwarzmüller, Brosi, Duman, & Welpe, 2018; Sheikh, Sood, & Bates, 2015). Moreover, a shift from a concentration solely to the return on investment and shareholders' value toward value creation for all stakeholders and sustainability achievement has become a remarkable movement in smart organizations (Albers Mohrman & Edward, 2014; Eason, 2016). Sustainability revealed that the smart organizations must be active for not only financial return, but also transformed people's mindset toward promoting community outcome, health outcome, and environmental return (Albers Mohrman & Edward, 2014). According to an in-depth study of the author to understand the important factors in digital transformation development by exploring 1500 articles, books, and scholarly resources from EBSCO, Pro-Quest, Emerald, Science Direct, Google Scholar, and SAGE and apply keywords, such as digital health, digital transformation, sustainability, leadership, change management, change leadership, empowerment, culture, engagement, change agent, transformation agent, and similar keywords, the author discovered the themes and interrelation between topic and subtopics. This exploration revealed that employee engagement, human resource empowerment, and culture development are the most common factors that researchers pointed them out for establishing digital transformation based on human factors (Abraham, 2012; Faddis, 2018; Huber & Gärtner, 2018; Kash, Spaulding, Johnson, & Gamm, 2014; Li,

2016; Miller, 2017; Roth & Keller, 2019; Schwarzmüller et al., 2018; Smollan & Sayers, 2009; Stensaker & Meyer, 2011; Tabrizi et al., 2019).

Ackerman (1986) described the transformation as the highest form of organizational growth after significant change and transition. "The key to transformation is linking people, process, strategy, and the best enabling technologies" (Anderson Consulting, 1994, p. 14). Barret (1998) stated that transformation is a shift from change to evolution. Tosey and Robinson (2002) described the transformation as a process of continuous change in the shape and structure of something. Change examines past changes and uses those changes to address current problems, whereas transformation is a future-based journey to achieve organizational goals by creating a new realm of possibilities (Appelbaum & Wohl, 2000). Mergel, Edelmann, and Haug (2019) expressed that smart organizations must reinvent their business models based on the digital transformation paradigm toward improving the lives of people and create excellent customers' experience, not only return on investment. Schwarzmüller et al. (2018) concluded that leadership is one of the significant factors in digital transformation and emphasized further research on the impact of leadership styles and self-development as a critical task for leaders during transformation. Although Schwarzmüller et al. (2018) emphasized human resource empowerment to overcome challenges during digital transformation, Mergel et al. (2019) concluded that processes, services, and relationships are the central bottleneck for digital transformation. Sainger (2018) also emphasized that the workforce's engagement and empowerment are two wings of successful digital transformation.

Quadruple Change

The approach of managing the changes and embracing transformation created a new realm in leadership that induces leaders to contemplate how to lead digital transformation successfully (Mbanaja, 2016; Schwarzmüller et al., 2018; Sheikh et al., 2015). Mergel, Edelmann, and Haug (2019) expressed that smart organizations could stay competitive in the digital era by using the internet and telecommunication, and they must reinvent their business models based on the digital transformation paradigm to improve the life of people and create excellent customers' experience. In pursuit of digital transformation, Reis et al. (2018) categorized digital transformation into three distinct elements: technological change, organizational change, and social change. However, due to digitalization, global changes must be embedded in the transformation journey. Therefore, the author created a framework called Quadruple Change shown in figure 1. The Quadruple change has four dimensions for delivering high value and balanced digital transformation: technical change, organizational change, social change, and global change.

Figure 1. Quadruple change

Technical Change

Digital transformation, due to the manifestation of the internet, Artificial Intelligence (AI), Internet of Things (IoT), big data, and cloud computing, has revolutionized organizations' context dramatically (Coile, 2000; UCSF, 2016). Arguably, digital health technologies have changed the form of service deliveries and organization setting; for instance, in healthcare, e-Health, robotic surgery, telehealth, Electronic Health Record (EHR), wearable sensors, and mobile health are the cutting-edge technologies shift the traditional model of healthcare to modern style. EHR has improved quality, process, and workflow, as well as cost-effectiveness (Reisman, 2017). Artificial Intelligence has become a powerful tool for simulating patients' behavior, supporting clinical decisions, and managing medications (UCSF, 2016). Big data fortifies forecasting the horizon of healthcare, improves population health by using massive data from multiple resources, increases healthcare stakeholders' satisfaction by predicting their preferences, and improves preventive medicine by analyzing the population health and patients' behaviors (Siegel, 2016). Moreover, telemedicine and mobile health have removed time zone and geographical barriers to delivering healthcare services to all patients through online platforms and smartphones (Bhutani & Paliwal, 2015). These technological changes have resulted in massive changes in human-related factors, such as culture, behavior, performance, response to change, and adaption to transformation (Coile, 2000; Reis et al., 2018; Young, 2000). Moreover, it caused an organizational change, social change, and global change that are described in the following sections.

Organizational Change

The implication of digital transformation has brought up different types of change in organizational dimensions, including changes in patients' life, clinical practice, behavior, management practice, operation, and business model (Reis et al., 2018; The Management Science for Health, 2004; Dina Ziadlou, 2020). However, Agarwal, Gao, DesRoches, and Jha (2010) indicated that lack of a rapid-learning system in health information technology adoption, as well as lack of partnership between government, public

health sector, global health sector, and medical centers, are the obstacles in the progress of digitalization. Besides, the lack of forecasting the implications of digital transformation at the individual level, organization level, and society level are the significant problems that researchers must consider in future research to alleviate the process of change.

Ismail, Mohamed, Sulaiman, Mohamad, and Yusuf (2011) concluded that the organizational success factors for creating sustainable digital transformation are human-related factors, such as culture, communication, and relationship. Matthews (2017) stated, " digital transformation is the constant rhythm of change collectively across people, technology, and processes" (p. 64). The author compared the old-age companies like Walmart with young-age companies like Amazon, a pioneer of digital transformation, and stated that innovation in the business model is the key to value-creation in organizational transformation. Therefore, in digital transformation, the factors that impact organizational evolution must be considered and aligned with three other dimensions to obtain balanced outcomes.

Social Change

The social changes due to the internet and social media manifestation are one of the significant parts that must be considered in transformation. The digital revolution has been the double-edged sword that has both positive and negative consequences in society. In e-life, advertisings, entertainment, and social media culture exchanges have affected all lives, especially kids and adolescences and their health, diet, and behavior (Goldstein, 2018; Murero, 2001). Goldstein (2018) debated the positive and negative impacts of the internet; in one hand, depression, mental issues, and social media addiction as negative consequences, and on the other hand, social engagement, culture exchange, and personal development, as positive consequences were discussed in his debate. On the positive side, people can manage their health through mobile applications. They can communicate with their doctors through medical platforms and do telemedicine. Likewise, they can manage their chronic diseases and mental health through e-consultation (Davies, Sharp, Homolova, & Bellis, 2019). According to Davies et al. (2019), while the digital age helps society to reduce inequity and increase access to healthcare for all, it is essential to understand differences by socio-demographic characteristics to support health-related actions. Per the authors' research, women use digital technology more than men. People with a higher level of general health are more willing to use digital health technologies compare with people with a lower level of general health. Moreover, individuals with health-harming activities like tobacco users, alcohol drinkers, and physically inactive people have less desire to use digital health services that healthy people. Likewise, the vulnerable populations, including children, women, and adolescents, need more affordable quality care. Therefore, the goal is not only implementing digital tools but also the goal is to understand the needs of these target groups in order to innovate and invent the right digital services for them (Bustreo & Tanner, 2020).

Likewise, the human risk factors, ethical issues, and mental problems arising due to digital technologies (Bustreo & Tanner, 2020) and they are the critical factors that must go under the magnifier of studies in public health to consolidate strategies based on four dimensions of change. Therefore, social change through the digital age manifestation must be one of the angles of quadruple change.

Global Change

While digital transformation has impacted the globe, the world gets flat, and all people around the globe are connecting more and more together in different dimensions, from economic factors and global trades to health and well-being and environmental factors. The COVID-19 pandemic has been one of the evidence of these days' intertwined world. On the other hand, megatrends contributing to global changes are climate change, new generation, connectivity and internet, urbanization, life expectancy, population growth, digital lifestyle, individualization, and cultural convergence (Atkinson, n.d.; BMI, 2018; Vielmetter & Sell, 2014). These megatrends can, directly and indirectly, affect human health. For instance, according to Mather, Jacobsen, and Pollard (2015), the aging population growth is one of the most considerable events in many countries, the same as the US. This population carries the chronic diseases such as obesity, and it is while the rate of obesity prevalence has been significantly increased among ages 65 to 75. In contrast, disability free-life expectancy has also been increased.

Although increasing life expectancy is positive, this population growth may create implications for the economy, healthcare, and social (Mather et al., 2015). Hence, in the digital transformation era, creating digital strategies drive the key factors of responding to the situation and harmonizing the quadruple change. Likewise, the concepts such as precision global health that offers innovation in a large scale to maximize the effectiveness and efficiency of healthcare services (Flahault et al., 2017), the decision support systems, information-driven systems, machine learning, and artificial intelligence can provide a huge context in health sciences and enable the learning systems to predict diseases, identify the origin of outbreaks, and detect health issues on a global scale (Flahault et al., 2017). With encountering Mega Trends that affect our health and well-being, directly and indirectly, the organizations must come into the arena as active players to contribute to global actions. The digital transformation has created tools to fortify this contribution.

Sustainable Effectiveness

A shift from a concentration solely to the return on investment and shareholders' value toward value creation for all stakeholders and sustainability achievement has become a remarkable movement in smart organizations (Albers Mohrman & Edward, 2014; Eason, 2016). A modern/post-modern organization is an organization that moves from command and control organizations (CCO) to high involved organizations (HIO) toward sustainable effectiveness organizations (SEO) (Albers Mohrman & Edward, 2014) shown in figure 2. The digital landscape has become an integral part of the 21st century, and it has strengthened the transformation of organizations to create value. In this journey, a smart ecosystem establishes strategies to shift from a command control system to a highly involved organization toward sustainable effectiveness organizations need to create value for people and the environment (Albers Mohrman & Edward, 2014). For this aim, a smart ecosystem needs engagement at local, national, and international levels to institutionalize sustainability (Falzon et al., 2017). However, local organizations have limited strategies in this field (Fleming, Wise, Hansen, & Sams, 2017). In the digital transformation literature stream, lack of strategies for attaining sustainability by organizations as well as lack of connection between sustainability and digital transformation has received surprisingly limited scholarly attention. Nevertheless, the workforces are not aware of sustainability and the power of digital technologies to enact meaningful worldwide changes.

Figure 2. A shift from CCO and HIO to SEO

Cultivating Agent of Transformation

The employee engagement, human resource empowerment, and culture development are the most common factors that researchers pointed them out for establishing digital transformation based on human factors (Abraham, 2012; Faddis, 2018; Huber & Gärtner, 2018; Kash et al., 2014; Li, 2016; Miller, 2017; Roth & Keller, 2019; Schwarzmüller et al., 2018; Smollan & Sayers, 2009; Stensaker & Meyer, 2011; Tabrizi et al., 2019). However, the organizations need employees who are the pioneer of change, who are the game changers, and the one can make a difference in the organization and society. Avedisian (1982) asserted that agents of change must facilitate organizational changes toward optimization. The Management Science for Health (2004) contended that the most critical factor needed to have successful practical change management is to have change agents in the organizations. Billington (2015) stated, "there is different between being digital and thinking digital" (p. 6). The organizations, such as healthcare, is a social system connecting patients, families, healthcare providers, communities, and all countries' health. Hence, healthcare needs agents of change (transformation) to reform the interpretation of individuals in digital services toward a common frame, reconcile disparities and conflicts of views, and articulate the impact of digital technologies on behavior, action, and the decision of care teams on individuals, society, and the world (Roth & Keller, 2019). Matthews (2017) and Sainger (2018) concurred that digital transformation requires capable leaders who have a vision and decision making power to decide how to transform organizations, navigate the adoption of changes, and inspire the workforce. Bratasanu (2018) indicated leaders and managers are the agents of change; for staying competitive, they must create and institutionalize strategic initiatives within continuous transformation; they are the responsible group in the organization to create shared value, enhance collaboration, and motivate individuals to achieve the goals. Indeed, in the fast-paced change era, the leaders' hard skills and also soft skills are essential to enhance productivity. Friedman (2018), a professor in the Department of Health Policy and Management of George Washington University, stated that leaders must adopt the new language and leadership skills, namely: system thinking, emotional intelligence, conversation skills, change management, and complexity management.

On the other hand, according to Kotter's change leadership theory (2012), change management focuses on processes and activities, and change leadership focuses on the relationship of people. Moreover, the organizations need to foster agents of change to influence and motivate others to embrace changes and achieving goals. Whereas change in organizations fixes the past problems and improves the current situation, transformation creates the desired future in a continuous improvement cycle that results in the flourishing of innovation and productivity in a dynamic environment (Kumar, 2019). Therefore, to update the Kotter change leadership based on our new era, the transformation leadership term can be

described as a way to lead transformation not only in technological changes but also in organizational change, social changes, and global change. Respectively, transformation agent term can be offered, instead of change agent, to illustrate the individuals' capabilities to progress transformation.

RESEARCH METHODOLOGY

This study utilized semi-structured interviews through a virtual video conference among ten digital transformation in global scale who had experience in digital transformation and leadership. The participants answered eight questions in 30 to 45 minutes to direct the findings toward responding to the central question: "What are the digital transformation strategies to cultivate transformation agents?". The studied phenomenon of interest in this research fell in the constructivism category (Mills & Birks, 2014), and the author explored the subjective meaning that individuals had experienced in digital transformation. The research method was a systematic plan to create a holistic view through data collection and data analysis. The author used NVivo software for analyzing the data derived from interviews. The data analysis was a framework analysis to formulate the participants' experience, identify a thematic framework, code, map, and interpret the findings. The seven themes were derived from the interview findings. The findings of the study created actionable strategies for healthcare organizations that can help in management practice.

Data Collection

The author collected data from real-time data through in-depth interviews of participants. The interview is the primary source of data collection in a qualitative study (Levy, Livingood, & Maranga, 2016). It is a valuable approach in qualitative studies because it creates a holistic view of information by enabling the participants to speak out with their voice and express their viewpoints and feelings about specific problems or opportunities on the heart of the subject. Alshenqeeti (2014) explained that researchers must establish a positive atmosphere during data collection because value, trust, meaning, and wording are the significant parts of the interview that must be achieved. The value of the words of interviewees, the honesty and accuracy of the communication, the meaning of words to convey the purpose of questions, and the conceptualization of the interview with short questions and elaborative answers impact the validity and accountability of the study (Alshenqeeti, 2014). The author recruited the participants from LinkedIn and the selection was purposeful selection to obtain information-rich responses. The author used a semi-structured interview protocol, including five demographics questions and 10 interview questions to obtain information rich response for central question. The duration of each interview was between 30 to 45 minutes. The interview sessions were held via video conferencing systems: Skype, Zoom, and Google Hangouts and were audio recorded by the audio feature of the platforms.

In addition, the researcher had for a back-up a smartphone recording application. Interview recordings were in a flash memory device assigned to this specific project. The author contacted the participants through an invitation email and also social media posts via LinkedIn. Upon the participant's acceptance to perform the interview, the researcher proceeded with the virtual interviews. The author elaborated on the subjects of the interview and submitted the Explanation of Research Form to each participant before starting the meeting and ensure them their anonymity would be maintained due to the confidentiality and privacy of information requirements of the study. The interview recordings were converted to a

Microsoft Word document by a transcription company and transferred into the NVivo software for data analysis. All corresponding communications for scheduling the interview, follow-up, post-interview, and thank you note were web-based via secure email. Afterward, the researcher sent the final version of transcription to participants for their review, correction, and approval upon the result of transcription.

Data Analysis

Data analysis begins by transcribing the retrieved data from the interview, observational notes, and documents to prepare data processing (Matthew B. Miles, Huberman, & Saldaña, 2014). According to Creswell (2014, pp. 197-200), data analysis consists of (a) organizing data, (b) looking for the meaning of the data, (c) coding the data, (d) generating descriptive themes and data relationships, (e) recognizing similarities and differences in the qualitative narrative, and (f) interpreting findings. The author cleaned up the data and determined which data would be related to the analysis process. The coding rule was used to map textual unite and identify categories, concepts, and patterns in the interview results.

Moreover, the author provided color-coding to illustrate similarities and extract common themes. For illuminating the serendipitous findings, the researchers need to follow three continuous, iterative processes in data analysis: (a) data reduction, (b) data display, and (c) conclusion verification (M.B. Miles & Huberman, 1994). Therefore, the data manually was analyzed for information cross-check and uploaded into NVivo. NVivo 12 software combines all manual data analysis and simplifies the process to identify patterns across various data, and it helps the researcher understand the connections of themes and patterns to support decisions (Fery, 2018). the author selected the participants' perspective code (for similarities/differences of participants' perspective about a specific experience) to concrete themes and develope the patterns.

Results

Seven major themes emerged from the data linked to the central research question, "What are the digital transformation strategies to cultivate transformation agents?". The compressed collection of themes for the study includes the following seven major themes: (a) mindset change, (b) new vision creation, (c) knowledge development, (d) innovation development, (e) motivation enhancement, (f) leadership support, and (g) collaboration.

New Vision Creation

According to Kotter's Eight-Step Model (2012), creating urgency, forming a powerful coalition, creating a vision of change, communicating the vision, removing roadblocks, creating short-term wins, accelerating consolidation, and institutionalizing in corporate culture are the essential components for successful transformational change. A survey conducted by Fitzgerald, Kruschwitz, Bonnet, and Welch (2014) revealed that the most common obstacles in digital transformation are lack of urgency, lack of vision, and lack of culture. For transformation, it is imperative to create a vision and encourage individuals to collaborate in achieving the desired future. Since organizations attempt to create future-based models thought quick adoption and adaption to new phenomena and rapid learning of new paradigms, it is critical to illustrate the vision and the roadmap. It engages the transformation agents with the concept of transformation and its ongoing improvement.

Figure 3. Cultivating transformation agents

Mindset Change

Marshak and Grant (2008) explained that the difference between classic organizations and modern organizations is their approach to leading change; the traditional organizations operate based on problem-solving while modern organizations build a new mindset and social agreement based on the organization's strengths. Bollington (2015) delivered, "There is difference between being digital and thinking digital" (p. 6). If the organizations plan to elevate their business models from command control to high involved organizations and sustainable effectiveness organizations, the first step of their action may start with mindset change among employees and leaders. The new world needs a new mindset of thinking to learn how to create a better future for all, how to create value for all, and how to effect on lives, society, and environment toward building sustainability. For this aim, a comprehensive plan to recognize the transformation agents and people who tend to step out from their comfort zone and make a difference may help the organizations to fortify the progress of mindset change. Moreover, empowering individuals to discover their capabilities and fortify their skills can help to have more transformation agents.

Knowledge Development

Knowledge development through creating educational material (knowledge creation) and developing training courses, mentorship, conference lectures, and webinars (knowledge sharing) to increase the awareness and knowledge of stakeholders about quadruple change is one of the approaches to empower the transformation agents. Chou (2005) and Van Opstal and Hugé (2013) clarified, there is a link between knowledge creation and knowledge sharing that can be affected by organizational learning mechanisms. Organizational learning refers to the ability of individual's in grasping knowledge and transferring it and

also the ability of individuals and organizations to store and retrieve the knowledge. Indeed, establishing a learning system to create, improve, and exchange knowledge, skill, and experience can support the cultivation of transformation agents. Farhan (2018) opined that a culture of continuous learning could be achieved by educating individuals.

Innovation Development

Innovation is a systematic process from generating an idea to implementation and utilization of the idea in reality toward increasing the effectiveness and efficiency of a system/organization. Kumar (2013) expounded, "Innovations conceived by carefully integrating design processes with business and technology have a better chance of achieving high user value and economic value, leading to greater adoption and market leadership" (p. 7). Rubenstein, Chakrabarti, O'Keefe, Souder, and Young (1976), De Brentani (1991), Rese and Baier (2011), Eschberger (2018) concluded that all success factors in the innovation process are human-related factors. Damanpour (2017) completed these authors' statement and asserted that innovation is not only about inventing technologies, but innovation can also be manifested in managerial innovation, such as innovation in human capital, leadership style, employee performance, and organizational innovation, such as innovation in culture and knowledge management.

Motivation Enhancement

Motivation is a driver of voluntary actions and achieving goals. (Danish & Usman, 2010)A study on the link between motivation and performance indicated that financial rewards, recognition, and promotion are the factors that increase employees' motivation and satisfaction (Danish & Usman, 2010). Irby (2011) explored motivational theories to identify employee motivation factors and indicated that a reward system and financial incentives contribute to increasing employee motivation. Moreover, Klonoff (2019) concluded that according to behavioral theory, human motivation is the key to digitalization because it aims to change the behavior of humans in response to services.

Leadership Support

The leadership is a combination of art and science to evolve changes and influence followers besides applying principles and techniques (Nahavandi, 2015). However, the art side is more potent because leaders can educate and learn the principles of leadership, but influencing followers to attain common goals must be derived from emotional and social skills to motivate and inspire the followers (Nahavandi, 2015). Babarinsa (2011) and Li (2016) emphasized the critical role of leadership on organizational change achievement and employee engagement in the process of change. Yang (2016) described the attributes of influential leaders in six characteristics to bring in action: personality, competency, courage, clarity, commitment, and compassion. Moreover, while transformation is a process not a goal, and today's work environments are pools of different generations, the leaders may adopt the techniques to provide socioemotional support for followers based on followers' characteristics, relationship, readiness, and acceptance (Dunn, 2016). To cultivate transformation agents, leaders have the responsibility to understand the mindset of the team, create a vision, support individuals in new ideas development, and encourage them to self-development and other development.

Collaboration

At the micro-level, Taylor (2019) defined collaboration as a key to successful change, and Offner et al. (2011) stated the main barrier to change is lack of collaboration due to employee resistance, poor implementation, and forced technology. At the macro level, Bowersox, Closs, and Drayer (2005) and Lawler et al. (2011) described the collaboration as an essential component of value-creation by engaging all businesses in not only gaining a competitive advantage but also creating value for the community, health outcome, and environment. One of the components of strategies for cultivating transformation agents is to fortify collaboration among transformation agents in order to create a coalition to achieve common goals.

SOLUTIONS AND RECOMMENDATIONS

Drawing on the findings and a reflection on them indicated that for establishing successful digital transformation based on quadruple change, there is a need for fundamental change in the mindset of employees to grasp insightful concepts of transformation and its connection with sustainable effectiveness. Toward this end, the strategies for illustrating the desired future (vision creation), empowering agents (knowledge development), and creating innovative environments (innovation development) are essential. Moreover, leadership support and motivations are the fuel of cultivating transformation agents. Likewise, to achieve goals, the collaboration of all individuals and their alliance is the key to making progress in attaining sustainable effectiveness organization.

According to the literature review and interview findings, inadequate knowledge about digital transformation, as an ambarella term for transforming technologically, organizationally, socially, and globally as well as a lack of awareness about sustainability, is still the pitfalls of many organizations. Developing organizational learning at all levels of organizations from top leaders to operational levels is a consolidation process that alters mindset growth. In doing so, one of the strategies is to increase awareness and knowledge of employees about digital transformation in four dimensions of change, quadruple change. The findings of the study revealed conclusive indications of an obligation to design training courses, lectures, webinars, and certifications in digital transformation in connection with sustainable effectiveness to cultivate transformation agents. For example, creating programs combining Quadruple Changes: technical, organizational, social, and global to boost individuals' knowledge about potential changes. In the content of the program: (a) technical change would describe the evolution of digitalization in healthcare; (b) organizational change would articulate leadership, people leadership, managerial innovation, self-development, and other development; (c) social change would delineate a broad view of healthcare as ecosystem and its effect on society; and lastly, (d) global change would open a new perspective in forward-thinking and global thinking for leaders and followers.

As a brief review, sustainable effectiveness organizations are the organizations acting not only for financial returns but also for environmental returns, health outcomes, and community benefit, and digital transformation is a future-based journey that works on present outcomes to create continuous improvement in quadruple change. Despite progress in technological advancement resulting in quality improvement, inefficient and ineffective usage of digital services and weak innovation in management practice has affected different aspects of organizations. The lack of innovative approaches in leadership practice, organizational culture, innovative decision making, and horizon scanning of the future have

become roadblocks for healthcare and have undermined transformation. Therefore, innovative approaches to foster digital transformation agents who can be the road opener and facilitator of transformation are recommended.

FUTURE RESEARCH DIRECTIONS

Future research may examine the multidimensional leadership roles in the organizational transformation to choose a particular leadership style to nurture digital transformation agents. Likewise, conducting qualitative studies to identify the effectiveness of transformation agents in organizational culture, in employees' resilience in change, and obtaining successful quadruple change are the opportunities that can be pursued by other scholars.

CONCLUSION

In order to accelerate digital transformation, smart organizations may cultivate agents of transformation. These agents enable to promote the progress of digital transformation in four dimensions of quadruple change. The first step is to create a clear vision about what the organization wants to achieve for its desired future. The second step is to change the mindset of individuals toward creating an alliance between four changes and its necessity for sustainable effectiveness establishment. Likewise, knowledge development to teach and learn the concepts of digital transformation and the responsibility of transformation agents is essential. Creating an open environment that agents can bring their innovation and ideas is another step. The factors like motivation enhancement contribute to earning more agents and help organizations transform from traditional models to modern and post-modern styles quickly. It is the art of leaders to support the movement of transformation agents by (a) engaging them in decision making (sense of ownership), (b) creating a shared vision for building desired future (meaning-making creation), and (c) motivating them for engagement in changes (reward system development-financial incentive). Lastly, the achievement of any goals in smart organizations requires collaboration and union of the employees. The agent of transformation can be the driver of this partnership inside and outside of the organization.

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KEY TERMS AND DEFINITIONS

Comfort Zone: It is a state on the mind in which people have control over their lives and feel a sense of ease with minimum vulnerability, stress, and anxiety.

Command and Control Organizations (CCO): A hierarchy organization with the commanders or managers on top that create direction and make the orders, and the followers must obey the rules.

Digital Transformation: Process of adoption and adaption of digitalization that involves people, strategies, culture, and operation of organizations.

High Involved Organizations (HIO): A network organization, the sense of ownership is high among the employees, and they have a significant contribution to improving the productivity and dynamic in their organization.

Mindset: It is a set f beliefs, assumptions, and worldviews of individuals that can be fix or changeable.

Quadruple Change: It is a framework for delivering of high-value transformation in organizations.

Sustainable Effectiveness Organization (SEO): A future-based organization that develops its strategies based on ensuring the next generation also will bless from all resources. It ensures its organizational activities to create profit will not create harm for people, not only local people but also people around the globe, and it will not damage and threaten the environment on either land or below water.

Transformation: A future-based journey with continuous improvement process toward creating effective outcomes.

Chapter 7
An Appraisal of Aadhaar and Digital Payments Strategies in India

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ABSTRACT

India has high digital ambitions despite considerable poverty, the digital divide, and continued high currency usage. Digitalisation has caused both excitement and fear in India – government and companies are excited about an increase in efficiency, closing the leakages, customer confidence, and satisfaction. The present study examines the role of digitalisation in the Indian economy, especially in creating a unique Digital ID (Aadhaar) and its impact on the economic, financial, and payment infrastructure. The study finds major innovations in cheque processing, real-time gross settlement, national electronic fund transfer, and other payment methods have considerably reduced the cost of banking facility in India. The Indian capital market has already witnessed electronic trading and settlement and has recently witnessed emergence of no-brokerage companies which can change the fundamental dynamics of the investment industry in India. The retail trade market, especially e-commerce, ride share market in India reflecting global trends, has also witnessed considerable "multi-homing."

INTRODUCTION

India has high digital ambitions despite the fact around 30 per cent of the population is below the poverty line (GOI, 2014). The Prime Minister of India, Mr. Narendra Modi remarked that "digital India is now a way of life"[1].Unlike other countries in the world, the Indian government was an "early adopter" of digital technology for authentication, public service delivery, financial sector transactions, tax filing, etc. Developing countries like India spend billions of money for economic and social welfare programmes.

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India had no nationally accepted way to prove identity and hence the majority of the intended beneficiaries had to resort to bribery to access welfare programmes. Studies have shown the money, which was supposed to have gone to the poor are stolen by rent-seeking officials and the estimates show such leakages of funds are as high as 70 to 85 per cent (Niehaus and Sukhtankar, 2013; Muralidharan et al., 2016). In fact, there was a need to develop a strategy to enhance digital capacity, based on the idea of "highly digital" and "cash lite" society (RBI, 2018).

Digitalisation is, broadly speaking refers to the proliferation and integration of computers and associated technologies into various spheres of everyday life (Hagberg and Kjellberg, 2020). The existence and availability of the World Wide Web have made the internet infrastructure as a club good and has equalised opportunities for global citizens -the world has become "flat" (Friedman, 2006). Based on that the digital infrastructure which the Government of India (GOI) undertook was a program to give each resident an identity card called "Aadhaar" card, which has biometric, along with demographic, information about residents (Sharma, 2010). This is the major initiative which changed the "digital landscape" and "game changer" for e-governance in India as it facilitated the creation of an "authentication process" of beneficiaries and audit of government service delivery (Sarkar, 2014; Banerjee, 2016;Chaudhuri & König 2018). Aadhaar is a multisided digital platform which provides avenue for "multihoming" where public and private entities can use it for customer authentication with no cost to the user. The Economist magazine in its editorial on September 5, 2020 issue commented on India Digital ID record as follows:

Creating a digital ID system is hard and expensive. Yet India, a gigantic and largely poor country, had managed it. Its "Aadhaar" biometric system has created digital identities for 1.3 bn people..(p12).

Digitising is also pushed in India as a strategy of pushing an economy with less reliance on and as a strategy of bringing the formal economy into the foreground and reducing the role of the informal economy (Lahiri, 2020). The strategy adopted by GOI called JAM trinity - consisting of Jan Dhan Yojana a bank accounts for everyone (financial inclusion), a unique electronic Aadhaar identification, and mobile banking facilitated by the unified payment interface (UPI). The UPI is an instant real-time payment system developed by National Payments Corporation of India facilitating inter-bank transactions on mobile platforms. The volume of financial transactions done through the UPI jumped from 17.9 million in 2016-17 to 12,518.6 million in 2019-20.The use of beneficiary identification through Aadhaar ID, digital payments and mobile banking have made cash transfers simple and enhanced the "capacity of the state" to deliver government programmes directly and without much leakage. Claims by GOI is that Aadhaar authenticated "direct benefit transfer" (DBT) of government programmes has led to "targeted assistance", considerable cost saving and efficient delivery of programmes. With COVID-19 pandemic, digital infrastructure and its technology have become the backbone of the economy. Covid-19 pandemic created health-risk for the population, but has also provided substantial opportunities for new ways of conducting shopping, business and government service delivery.

MAIN FOCUS OF THE CHAPTER

This chapter critically examines India's unique digitalisation record, especially the role of Aadhaar in developing multi-sided market and innovation in payment systems (like bank accounts, investment accounts, mobile banking, virtual banks etc.) and its impact on consumers, business, government and

economy. The chapter is organised as follows: Section 2 provides an overview of the digital capacity building in India. Section 3 provides a review of the literature on Aadhaar multi-sided platform. Section 3 provides an analyisis of Aadhaar centred digital platform in India and the last section summarises the conclusions of the paper.

DIGITAL CAPACITY BUILDING IN INDIA

The Institute of Management Development (IMD) carries out research to analyse and rank 63 countries all over the world based on their ability to adopt digital technologies leading to transformation in public services, business models, and society as a whole (IMD, 2020). The ranking is based on 3 key factors. The key factors are (1) Knowledge, (2) Technology and (3) Future readinesses. The "knowledge factor" refers to the competence to develop new digital innovations and the sub-factors are talent, training and education and scientific concentration. The "technology factor" is the all-encompassing context that enables the development of digital technologies which involves regulatory framework, capital and technology framework. The "future readiness factor" is the preparedness of a country to exploit digital transformation which involves adaptive attitudes, business agility and IT integration. India is ranked 48th in overall performance among 63 countries in 2020 (Table 1). At the top of the IMD World Digital Competitiveness Ranking 2020 are: the USA, Singapore, Denmark, Sweden and Switzerland. The United States follow a balanced approach between knowledge generation, the creation of supporting environment for technology development and a readiness to adopt an innovation. Sweden, Singapore, Denmark and Switzerland give priority to one of two factors. India fares relatively well (6th rank in 2020) in "Graduates in Sciences' component of Training and education sub-component of knowledge component.

The digital transformation could happen at the firm, government and society level. In India, it has happened at the firm level and that also in the private sector with government playing a facilitating role in the creation of a public infrastructure for authentication called "Aadhaar" which could be used for authentication at no cost to public and private sector users. India is well known in the world for information, communication and technology consultancy companies and high skilled knowledge worker pool. The top ICT companies like Microsoft, Google, Adobe, IBM and many of the new startups in silicon valley in the United States are headed by Indian-born geeks and a considerable proportion of the knowledge workers in these industries are of Indian origin. India has been a major beneficiary of the H1B visa programme of the United States where Indian and US companies bring outside (Indian) knowledge workers to meet the demands of the ICT industry. The rise of Indian ICT companies and Indian knowledge workers can be traced to the "Y2K" problem in which Indian companies achieved international acclaim for patching the Year 2000 bug facing new century dates arising out legacy softwares (like COBOL, FORTRAN etc.) facing new century dates. The success of the Indian code writers procured new business to develop software to help people around the world. Ever since, Indian ICT service companies and their programmers have dominated the programmers service market, including Apple, Alphabet, Facebook, Google, Microsoft, etc. Taking advantage of the existence of large cohort of information, communication and technology talent in India, the Indian government had adopted a strategy of "drinking from the rich pool of knowledge workers" and deployed various large-scale digital projects for its governance and implementation of welfare programmes. Besides the government and regulators of financial intermediaries introduced various FinTech especially in banking, payment and settlement platform digitisation in India. FinTech in India is primarily driven by the payments sector. There are has

around 1,500 FinTech companies in the area of digital payments (including digital wallets, P2P transfer applications, and mobile points of sale). The National Payments Council of India, through the Unified Payments Interface (UPI), has leveraged the growing presence of mobile phones to reduce the cost of financial infrastructure. The National Payments Council of India has also introduced products such as RuPay cards, allowing faster money transfers and improved customer experience.

Table 1. IMD World Digital Competitiveness (WDC) Overall and Factor Ranking by Country-2015-20.

Countries		Rank				
	2015	2016	2017	2018	2019	2020
(a) Overall						
USA	2	2	3	1	1	1
Singapore	1	1	1	2	2	2
Sweden	5	3	2	3	3	4
Denmark	8	8	5	4	4	3
Switzerland	7	7	8	5	5	6
India	50	53	51	48	44	48
(b) Knowledge						
USA	6	4	5	4	1	1
Singapore	1	1	1	2	2	2
Sweden	2	3	2	3	3	4
Denmark	9	8	8	8	6	6
Switzerland	5	3	4	6	2	3
India	37	39	37	46	38	39
(c) Technology						
USA	6	5	6	3	5	7
Singapore	1	1	1	1	1	1
Sweden	9	4	5	5	7	6
Denmark	13	12	10	10	11	9
Switzerland	11	9	8	9	10	11
India	58	57	59	53	49	50
(d) Future Readiness						
USA	3	1	2	2	1	2
Singapore	5	4	6	15	11	12
Sweden	9	8	5	5	6	7
Denmark	6	6	1	1	2	1
Switzerland	10	10	13	10	10	5
India	53	54	51	48	46	56

Source: IMD (Various issues).

The GOI in its 2014-15 budget decided to set up 100 "smart cities" in India. Under this programme 100 smart cities were to be created with total investment of Rs. 48,000 crore ($7.2 billion), and Rs. 500 crore in each city during the period between 2014-2015 to 2019-2020. A total of Rs. 98,000 crore (US$14 billion) was approved by the Indian cabinet for the development of 100 smart cities and the rejuvenation of 500 others. The idea of smart city is understood differently by different authors. Caragliu et al., (2011) view it as a concentration of highly educated and creative works. US based Smart Cities Council defines a smart city as one that has digital technology embedded across all city functions. Burte (2014) defined smart city as a system which "leverage various computational, networking, self-regulational, and responsive capacities that ICTs can embed into administrative and infrastructural systems (like transport, power and water supply, for instance) and enable more effective, efficient, responsive and resilient management of city amenities". But a central characteristic of smart city movement is pervasive use of ICTs (Information and Communications Technology) technology to improve the efficiency and quality of urban infrastructure. In India smart city mission envisaged developing an area within the cities in the country as model areas based on an area development plan, which is expected to have a rub-off effect on other parts of the city, and nearby cities and towns. Cities were selected based on the Smart City's challenge, where cities will compete in a countrywide competition to obtain the benefits from this mission.

In order to spur digitisation and "cleanse" the economy, on November 6, 2016, the government announced the controversial demonetisation of 500 and 1,000 rupee notes. During the demonetisation drive, the government provided incentives for using digital payment systems to progress the pace of its adoption. The global COVID-19 pandemic has necessitated social distancing and digitisation has become a necessity and that has led to fundamentally change in trajectory of several consumers, businesses and governments. Under Covid-19 pandemic, the digital-delivery model had opened up tremendous opportunities for the Indian ICT sector, especially in the area of talent sourcing, digital education, retail business, health care etc.

REVIEW OF LITERATURE

Since the pioneering paper of Rochet and Tirole in 2003, the theory of two-sided or multi-sided markets has received considerable academic and regulatory attention (Caillaud & Jullien.; Rochet and Tirole, 2003; Eisenmann et al., 2006;. Armstrong et al., 2007; Rysman, 2009). For a better understanding of two-sided markets, one need to contrast it with one-sided market. One-sided markets also have intermediaries. For e.g., a local farmer that sells a product to Wallmart at wholesale price and Walmart in turn sells its consumers at retail price can be considered as a one-sided market. But if Walmart sets up a digital platform for a farmer (or producer) and sets up the retail price could be considered as two-sided market. Two-sided platforms cater to the tastes of two groups of users—in many instances, buyers and sellers. Decisions among these groups are interdependent because of positive cross-group external effects. Prominent examples include payment cards (composed of cardholders and merchants); health care firms (patients, health care providers, insurers etc); operating systems (end-users and developers); advertisement platforms like Google (advertisers and consumers); shopping malls (consumers and shops); video-game consoles (gamers and game developers); recruitment sites (job seekers and recruiters) etc.

Despite the widespread use of the term 'two-sided markets' terminology, there is increasing evidence that many platforms may cater to more than two markets (e.g., Amazon may cater to its own products, vendors, advertisers etc.). However, there is considerable disagreement among economists about the

appropriate definition of two-sided market. Most existing definitions of two-sided markets focus on the presence of important cross-group or indirect network effects between the two or more customer groups participating on the platform. Caillaud and Jullien (2003) require the presence of some indirect network externality across distinct groups of intermediaries' customers. Rochet and Tirole (2003) note that "many if not most markets with network externalities are characterized by the presence of two distinct sides whose ultimate benefit stems from interacting through a common platform." Armstrong (2007) defines two-sided markets as markets involving "two groups of agents who interact via 'platforms,' where one group's benefit from joining a platform depends on the size of the other group that joins the platform.".According to Rysman (2009), a two-sided market is one in which (a) two sets of agenets interact through an intermediary or platform and (b) the decision of each set of agents affect the outcome of other set of agents, typically through an externality. The definition of Rysman (2009) highlights the existence of the platform and the interdependence among the different sides but is silent whether a platform is necessary. But Rysman (2009) emphasises the importance of indirect network effects to be considered two-sided markets. The emphasis on the existence of network effects implies it could be multi-sided.

Two or multi-sided markets represent a subset of the literature on network effects (Eisenmann, et al., 2006; Rysman, 2009). Two or multi-sided market literature emphasises the indirect network effects. The concept of network effects was first proposed by Katz and Shapiro (1985) who distinguished between direct and indirect network effects. They defined direct network effects as consumers benefiting directly from others buying the network good and indirect network effects as consumers benefiting from others buying the network good due to the increase in complementary goods. The extant literature on two-multi-sided markets focused on the actions of the market intermediary especially pricing choices, while literature on network effects focused on adoption by users and optimal network size (Rysman, 2009).

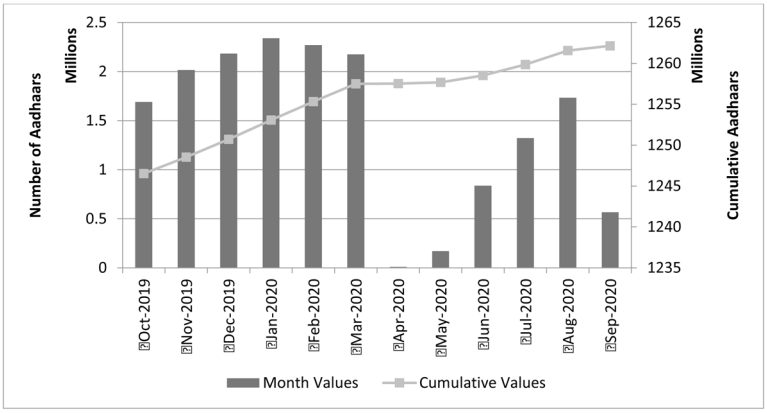
Weyl (2010) characterise multi-sided market as consisting of three features: (a) multi-product firm- the platform provides distinct services to two sides of the market, (b) cross network effects- benefits depend on the user participation on the other side of the market and (c) bilaterial market power-platforms are price setters (monopolistic or oligopolistic) on both sides of the market and typically set uniform prices. Pricing (participation and transcation fees) in multi-sided markets depands not only elasticity of demand but also the size of the market on the other side.

AADHAAR DIGITAL PLATFORM

Aadhaar is an electronic platform of multi-sided market with multihoming possibilities for market participants like government, banks, tax authorities etc. Presently it provides basically authentication services at no cost to the users although it is a monopoly. The groups which demand its services (authentication) are government (DBT, tax etc), firms (financial firms) and households. Since Aadhaar offers free access to the platform, it provides avenue for other participants to use this platform more and multihoming i.e., to connect to several platforms. India's Aadhaar (meaning foundation), which sits at the centre of the trinity is the largest national biometric identification programme for 1.3 billion people and has the capacity to authenticate 100 million (or 10 crore) transcations a day. The cross network effects of Aadhaar is substantial as more and more users participate in the platform and derive and give value to other participants.

In India, the GOI was faced with two limitations for an efficient implementation of welfare programmes. First, India had no nationally accepted way to prove identity (lack of identity document) and hence majority at the bottom of the pyramid had to to resort to bribery (corruption) to access government welfare programmes A solution was sought in bio-metric identification technologies that would use unique and immutable bodily indices to decide on a person's'real'identity . The Aadhaar project was initially sold to the public -based on the claim that enrolment was "voluntary". But it was made mandatory (called Aadhaar integration) for a wide range of facilities and services (like salary payments, old-age pensions, school enrolment, train bookings, marriage certificates, getting a driving licence, buying a SIM card, using a cybercafé etc. (Dreze, 2016). Aadhaar integration is achieved through two ways: One is called "Aadhaar seeding" where a data field for Aadhaar number is added to the for a range of other requirements in the Management Information System (MIS) required for these programmes. This is supposed to eliminate identity fraud by weeding out "bogus" or "ghost" applicants. The second is called Aadhaar-based biometric authentication (ABBA) and refers to the practice of installing a Point of Sale (PoS) machine equipped with fingerprint reader and authenticating the person each time the person accesses his/her entitlement.Launched on January 28, 2009, the number of Aadhaar IDs issued till August 2020 comes to 1.265 billion, which is an unprecedented achievement (See Figure 1).

Figure 1.



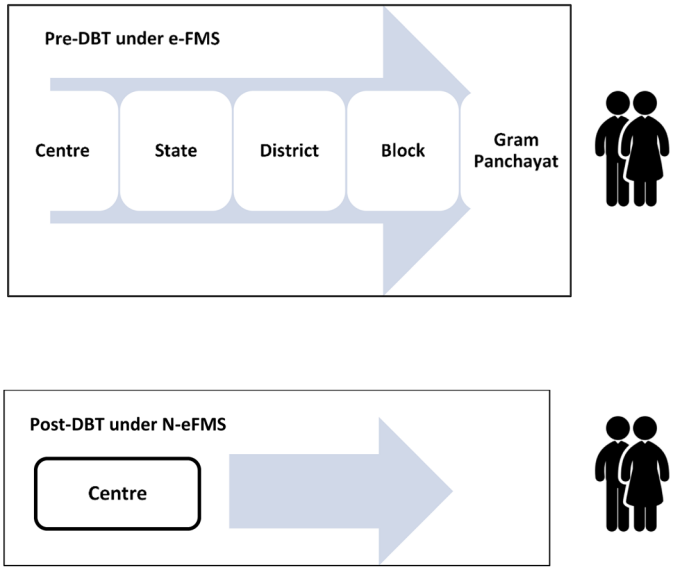
India's unique identification number (UIN) system, Aadhaar card is a 12-digit unique identification number that can be obtained voluntarily by residents of India, based on their biometric and demographic data. The UID is a randomly generated 12-digit unique identification number which is stored in a central data bank and linked to person's biometric data-fingerprints, iris scan data and facial photograph (age, sex, age, address, fingerprints etc.) which is a relational database management system, or RDBMS. The data are collected by the Unique Identification Authority of India (UIDAI), a statutory authority established in January 2009 by the GOI.

The Aadhaar database provides free and instant authentication of identity and also online Know-Your-Customer (KYC) authentication. The system is designed to handle 100 million simultaneous authentication requests. This has considerably enhanced the "state capacity" to deliver government services and

authenticate banking transactions. This has also considerably reduced the cost of operations of banking and payment services.

The main criticism against Aadhaar identity card issuance is based on the argument that Aadhaar card itself is based on manipulated documents. To get an Aadhaar card, one should normally submit two existing ID proofs (like ration card, voter ID, driving license etc.) which are prone to manipulation and fraud (Drèze 2016; Drèze and Khera, 2017; Khera 2017). Thus critics argue that UIDAI used ".. flawed IDs to enrol for Aadhaar that it had rejected as error-ridden.." (Khera, 2017, p.62). The second way, Aadhaar could be procured is the "introducer" system which is meant for those people who were lacking in pre-existing IDs. According to critics only 0.03% of Aadhaar numbers were issued through the introducer system (Khera, 2017). The second criticism of Aadhaar card system is the argument of "efficiency gain" of correctly identifying "real" beneficiary is misleading as critics argue that most of the gains is on account of imposition of stringent caps on coverage arising out of budgetary constraints rather than correcting the fraud. This shows up as gains of DBT and elimination of fraudulent beneficiaries. Besides, it is also alleged that many Indians are unable to register and are deprived of government welfare benefits. Regardless of these allegations and limitations, Aadhaar digital ID has streamlined government services and reduced fraud. A case in point is the fraud in PM Kisan scheme in Tamil Nadu in 2020. An estimated INR 1.1 billion was fraudulently credited to the bank accounts of 0.55 million ineligible people in 13 districts of Tamil Nadu under the Pradhan Mantri Kisan Samman Nidhi (PM-Kisan) Scheme. Detecting the fraud was possible through Aadhaar ID and the government has been able to recover INR 320 million so far[2].

Figure 2.



Source: Government of India- Economic Survey 2018-19

Direct Benefit Transfer (DBT) Linked With Aadhaar Card

Direct Benefit Transfer (DBT), or the transfer of subsidies directly to the beneficiary bank accounts, along with using Aadhaar/Unique ID as the identification proof, has been hailed as the ability to reduce leakages in the government welfare administration. Figure 2 provides a comparative picture of funds flow during the pre-DBY and post-DBT in India. As is evident the post-DBT eliminates a number of approval process/entities and provides funds directly to be beneficiaries with less time, cost and efficiency. Based on authentication of Aadhaar card, GOI has transferred around $45 billion as subsidies to the beneficiaries without any involvement of much involvement of bureaucracy (Raghavan et al., 2019). In total, DBT is now implemented for 1,182 schemes supervised by 75 ministries and government departments. The main DBT is on account of Liquified Petroleum Gas subsidy, payment of wage bills of MGNREGA, public distribution system (PDS), the midday meal (MDM) etc.

In India, subsidies on diesel and petrol have been gradually eliminated, but LPG still remains heavily subsidised (around 86 per cent) due to its benefits of replacing polluting cooking methods in households and associated health benefits in India. In India, public sector oil marketing companies sell LPG to households and to the commercial sector through a distributor network. Commercial establishments and households consuming more than 12 cylinders in a year have to buy LPG at subsidised prices. Commercial establishments have to additionally pay central and state taxes of about 25–30 per cent on an average. The rationale behind Aadhaar-linked DBT is that technology can help states with low administrative capacity to efficiently curb diversion of subsidy. In the DBT scheme, consumers have to register their Aadhaar-linked bank accounts with their LPG distributor. Consumers pay the full cost of LPG to the distributor and the subsidy is transferred directly to their bank scheme implemented under DBT. We discuss in the following paragraphs another large scheme implemented under DBT called Mahatma Gandhi National Rural Employment Guarantee Scheme.

Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS)

The MGNREGS is India's largest social safety net programme for rural areas. It was initially known as National Rural Employment Guarantee Scheme and was passed in 2005. It was renamed as MGNREGS in 2009 and mandates 100 days of guaranteed wage employment in a financial year to every rural household whose adult members volunteer to do unskilled manual work. It was implemented initially in 200 most backward districts from February 2006 and subsequently extended to all the districts. Under MGNREGS, every rural household is entitled to a job card, which has names and photographs of all adult members of the household who can demand and receive work[3].

Under MGNREGS, funds for beneficiaries were transferred to the local Panchayat bank accounts who, after verification of identity of beneficiaries transferred wages directly to their bank accounts as shown in the upper section of Figure 2. This process had two main problems. First, many beneficiaries in rural areas did not have bank accounts. Second the validation of the identity of beneficiaries took considerable time and most often led to corruption at local level. By linking an Aadhaar number of bank accounts (under drive of financial inclusion), the entire cross verification was done efficiently. By expanding mobile payment options, the government was able to overcome bank internet connectivity problems in rural areas and ensure the smooth process of release of funds to the beneficiaries cutting various intermediaries as shown in the lower section of Figure 2. Empirical studies by Muralidharan et al., (2016) using a randomized experiment of smart card usage in both treatment and control group in

157 sub districts and 19 million people of Andhra Pradesh found that the new system (with smart cards) delivered a faster and less corrupt MGNREGS payment process without affecting the program access.In a recent study Banerjee et al., (2020) of MGNREGS in India found that digitilisation (e-governance) of the programme has led to programme expenditure reduction of 24 per cent, while employment slightly increased.

The Jan-Dhan-Aadhaar-Mobile (JAM) Strategy

The JAM trinity was first propounded in the GOI's Economic Survey 2016. Along with bank accounts for everyone (Jan Dhan Yojana), a unique electronic Aadhaar card (A) and mobile (M) banking facilitated are the core of the digitisation package commonly called JAM trinity. The GOIs JAM trinity strategy seeks to build state capacity in governance and delivery of programmes. The idea is to exploit the three modes of identification to deliver direct resources to the poor directly.

Jan Dhan Yojana (J)

The first letter, the "J" of the trinity, is the Pradhan Manti Jan Dhan Yojana (PMJDY). It is the world's biggest financial inclusion program. Prior to PMJDT there were efforts to open Basic Savings Bank Deposit Account (BSBDA) since 2010. Under the BSBDA there were provisions for opening "no frills" zero-balance accounts. PMJDY went further and added further additional services. PMJDY has two components. The first component includes opening a bank account and linking it with RuPay card (Indian version of credit and debit card), pension and insurance schemes for an upliftment of the under-privileged. PMJDY account holders are supposed to get a RuPay debit card with inbuilt accident insurance cover of Rs. 1,00,000, an overdraft facility up to Rs.5,000 and a life insurance cover of INR 30,000. The second component refers to automation of all direct benefit transfer schemes to plug leakages in the system. In December 2015, the government directed all the banks to convert and tag all the accounts opened prior to the launch of PMJDY and yet were the beneficiaries of DBT payments, into PMJDY accounts. Besides, government sponsored social security schemes like Pradhan Mantri Suraksha Bima Yojan and Atal Pension Yojana were to be implemented through this account.

The main criticism of this scheme is that although there was a substantial increase in the number of bank accounts opened, the average balances in these accounts were low; 17 percent of these PMJDY accounts had zero balances as at the end of 2018 and one-fifth of these accounts is dormant (Sinha and Azad, 2018). Needless to say, it is really an achievement that around 10 billion accounts was opened and balance of Rs.1005 billion is maintained in these accounts as balances as at the end of June 2019. The opening of these bank accounts creates a pathway for government welfare programmes to be targeted

Payments Bank and Financial Inclusion

Payments bank is the latest inclusion in the Indian digital, paperless, cashless and mobile banking industry (Chakraborthy, 2019). A payments bank is allowed to accept demand deposits (up to a maximum of INR 1,00,000 per individual), and can issue only ATM and debit cards and other prepaid instruments. It can provide payments and remittance services, and internet banking, but no lending (provide loans and credit card) is allowed. Payment banks have to hold 75 per cent of its demand deposits in Statutory Liquidity Requirements (SLR) eligible securities of which the pre-dominant category is the government

treasury bills and securities. A maximum of 25 per cent can be held in the form of current and time/fixed deposits with other scheduled commercial banks for operational purposes and liquidity management, Since the objective of financial inclusion is paramount to payment banks, the primary beneficiaries of such services will be migrant labourers, low-income households, small businesses and other unorganised sector entities. Since payments banks are not supposed to carry any significant credit and market risks, they will still be subject to operational and liquidity risks.

In August 2015, the RBI provided in-principal license approvals to 11 entities to start up payments banks. These were Aditya Birla Nuvo, Airtel M Commerce Services, Cholamandalam Distribution Services, Department of Posts, Fino PayTech, National Securities Depository, Reliance Industries-SBI, Dilip Sanghvi–IDFC–Telenor JV, Vijay Shekhar Sharma, Tech Mahindra, and Vodafone M-Pesa. Subsequently, in the course of setting up businesses. Three of them (Cholamandalam, Sanghvi–IDFC– Telenor, and Tech Mahindra) surrendered their licences in 2016, citing the model to be unviable due to regulatory impositions such as the limits placed on deploying deposits freely so that fee income was the only source of revenue, and the challenges of customer acquisition in the face of stringent KYC norms. These three entities also expressed worries about high compliance costs, competition from other payments banks, and the long gestation period for profitability implicit in the business model.

In November 2016, Airtel launched India's first payments bank by beginning operations in Rajasthan on a pilot basis. In January 2017, India Post Payments Bank (IPPB) became the second entity to start operations. As of December 2018, IPPB had opened nearly 1.9 million accounts and facilitated close to a million transactions. Following Airtel and IPPB, the other licence recipients have also set up their respective payments banks. Presently, payments banks are in uncharted territory and their viability is a big question mark (Ghosh and Ranade, 2020).

Mobile Phone

The last and the most critical leg of the JAM trinity is the "M" – Mobile that can automatise or digitise the delivery and payment systems. India, is the second fastest-growing wireless (mobile phone) market in the world. About 15 per cent of India's 1.3 billion people use mobile- phone services, which are offered at rates as low as 2 U.S. cents a minute. The number of wireless telephone connection in India increased from 6 million in 2000 to around 1144 million as on end-May 2020 of which urban mobile phone connections account for 54 per cent and rural around 46 per cent[4]. India has around 560 million internet subscribers and Indians spend on an average of 17 hours a week—than social media users in China and the United States (Mckensey,2019). India has the lowest cell phone price in the world (Table 2). The average pre-paid plan comes to $0.02 in India compared with $0.20 in the United States.

Table 2. International Comparison of Cell Phone Plans and Prices- 2010

Countries	Unlimited Plan ($ /monthly)	Pre-paid Plan ($/text)	Post-paid Plan ($/text)
Canada	$14.59	$0.14	$0.02
Denmark	$14.00	$0.03	$0.03
Finland	N.A	$0.10	$0.04
Hong Kong	N.A	$0.06	$0.06
India	$2.00	$0.02	$0.01
Japan	N.A	N.A	$0.00
South Korea	N.A.	$0.02	$0.01
Sweden	$11.00	$0.04	$$0.00
Taiwan	N.A	$0.04	$0.04
United States	$20.00	$0.20	$0.05
United Kingdom	N.A	$0.15	$0.10

Note: N.A. – Not available.
Source:Moses et al. (2010)
https://www.newamerica.org/oti/policy-papers/an-international-comparison-of-cell-phone-plans-and-prices/

The volume of wireless broadband data consumed by Indians has risen sharply, from less than 200 million gigabytes (GB) a month in 2016, to around 1.3 billion GB a month in March 2017[5]. The growth indicates the disruptive effect of Reliance Jio Infocomm Ltd entering into the internet and telecom market in India. The data prices per GB have fallen from around $3.5 to $1.8 in the same period while Reliance Jio charges its customers around $0.17 a GB. The growing dominance of mobile as the medium of choice in India. India fares also better on the data front, with the annualised cost of 1 GB of data a month working out to less than 2 per cent of per capita GDP of the average Indian. With Reliance Jio entering the internet service market, the internet market has changed dramatically. The top three operators in the mobile phone data by market share are Reliance Jio, Airtel and Vodophone Idea which together account for 90 percent of the subscriber base.

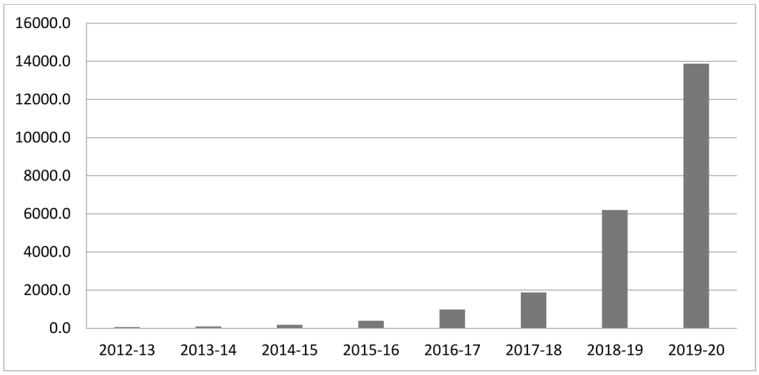
India being the second largest mobile market in the world, mobile banking provides convenience and cost-efficient banking services. It also enables to avoid huge queues which one encounters in a normal bank branch. Mobile banking enables one to provide banking facilities in unbanked areas which, according to World Bank estimates is around 21 per cent in India. Although mobile banking is at present in a nascent stage, mobile banking has shown a quantum jump from 53.3 million transactions, in 2012-13 to 13,873.6 million transactions in 2019-20 (Figure 3). The two-way authentication system for banking transactions mainly through mobile has made banking and mobile banking safe and one of the best in the world. The value of mobile banking has also shown huge increase – from Rs. 0.6 billion in 2012-13 to Rs. 578 billion in 2019-20 (Figure 3). In India, banks which are licensed in India are permitted to offer mobile payment services to residents of India. The services should be restricted to only to bank accounts/ credit card accounts in India which are KYC compliant. The per day transaction cap of Rs.50,000 has been removed by RBI, and every bank can change this cap depending upon their risk appetite.

The modernisation of the information technology systems of banks and their core banking solutions, has made possible the integration of various delivery channels. The large number of mobile phone users

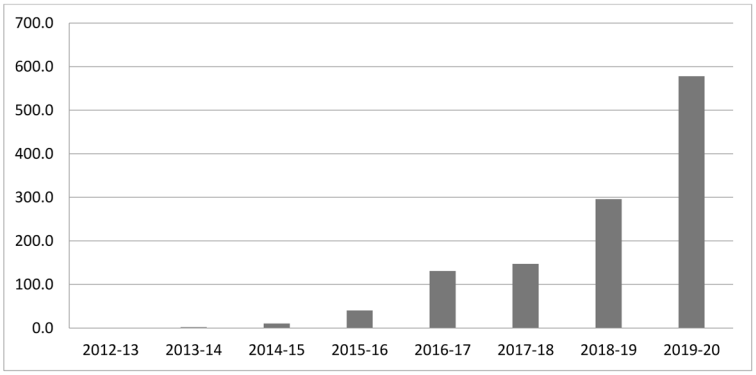
and the availability of cost-effective internet data have led to an increase in the number of mobile internet users. Taking advantage of this, an increasing number of payment facilities are being integrated through the mobile channel. Further, the introduction of a unified payment interface (UPI) has revolutionised the mobile payment system.

Figure 3.

(a) Mobile banking- volume (in Millions)



(b) Mobile banking – value (in Billions)

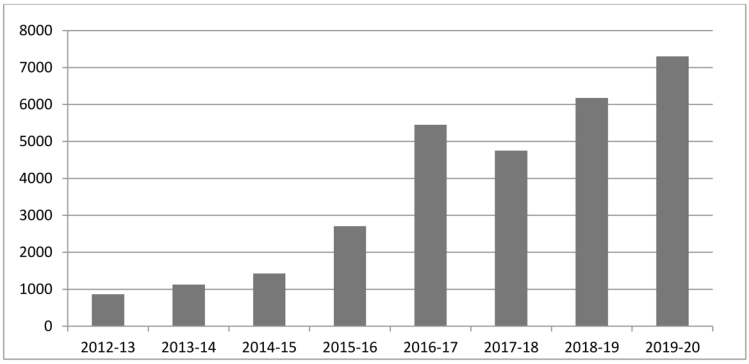


Source: RBI- Handbook of Indian Economy (Various Issues)

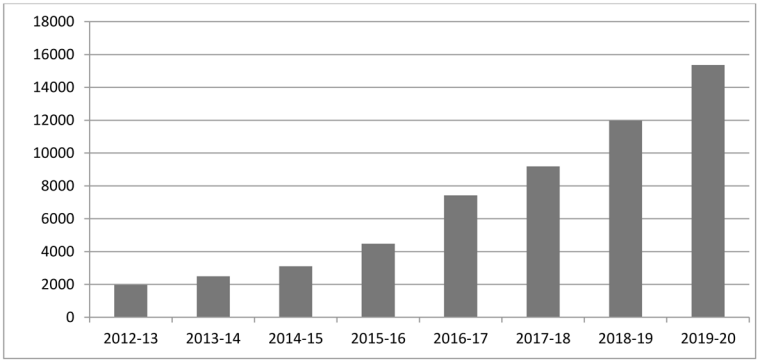
Is JAM trinity model a success in India? Studies done in India based on a survey of financial inclusion for year 2014 and 2015 find strong evidence of among JAM variables (Ghosh, 2017). The study found that the complementary is primarily between PMJDY (J) and Aadhaar (A) but less with mobile telephony.

Figure 4.

(a) Card payments – volume (in Million)



(b) Card payments- value (in INR Billion)



Source: RBI- Handbook of Indian Economy (Various Issues)

Debit Card and Credit Card

In India the use of credit card based payments system was limited inspite of its existence for 40 years. This was on account of high cost of payments and unsatisfactory user experiences (Raghavan et al, 2019). The UPI which was introducted by RBI and the Indian Banks Association in 2016 was created as a protocal that simplified funds transfer to and from bank accounts as well as other digital wallets. Since all the banks in India use UPI specification, there was substantial increase in use of digital payments in the form of credit and debit cards.

Reflecting the increasing digital payments on account of use of UPI specification in the country, card payments (debt and credit) volume in India have increased from 1,423 million in 2014-15 to 7,301 million in 2019-20 (nearly 7 fold increase) (See Figure 4). At the same time, the value of the card payments transacted during the corresponding period increased from Rs. 3113 billion to Rs. 15358 billion (nearly 6 times).

Has Demonetisation Facilitated Digitalisation?

On November 8, 2016, GOI announced demonetisation of Rs. 500 and 1000 notes valued at Rs. 15.4 trillion. The announced intention of demonetisation was to reduce black money/tax evasion, eliminate fake currency, etc. Reducing the extent of cash in transactions and encouraging digital transactions was later on added to the objectives. The value of banknotes in circulation declined by 20.2 per cent during 2016-17 to INR13,102 billion as at the end-March 2017 (RBI, 2016-17).The demonetisation amounted to 86 per cent of the total currency in circulation (CiC). After the demonetisation period, the RBI announced that over 99 per cent of the demonetized notes has come back to the banking system (Lahiri, 2020). The currency in circulation, which dipped in 2016-17 was also back to the pre-demonetisation level. A study by Chodorow-Reich (2020) also found using employment and night lights data that demonetization led to a cash shortage of 2 percentage points in 2016Q4. An examination of digitised payments, the tax base and tax revenues found that demonetisation did achieve little in changing the course of digitisation payments (Lahiri, 2020). Similarly, a study by Chakrabarthy et al., (2020) also looked at various payment system indicators (like RTGS, cheque clearing, credit car, debit card, mobile payments, etc. and found no significant change (or outlayer) in these indicators because of the demonetisation episode in 2016-17.

SOLUTIONS AND RECOMMENDATIONS

The above analysis highlights the importance of Aadhaar-based digital revolution in India. Currently, Aadhaar is predominantly used by public sector entities and financial institutions for client authentication. The Aadhaar platform has the potential to be a two-way platform offering enormous potential for the private sector. To reach the scale and utility of Aadhaar platform, private sector entities who operate on the supply and demand side of various markets as well as customers demand to be incentivized and trained so as to achieve its social welfare. At the same time, a digital warning need to be issued as digitisation of product, process and related services could lead to underutilisation of labour and accentuate already grave inequalities in the society. The trade-off between digitisation and the labour displacement is expected to be a number of factors, including efficiency gains and benefits to society.

Digital platforms are inherently based on the "win takes it all" axiom. This is less desirable since it could lead to monopolistic practices and behaviour that are not in the interest of consumers. Hence, regulation has an important role to play in combating anti-competitive behavior and practices.

FUTURE RESEARCH DIRECTION

Most of the research is confined to impact of direct benefit transfer programmes of government and their impact. An area of research which needs to be spurred up is the impact of the various impacts of banking and payments infrastructure on the customer satisfaction/outcome.

One of the concerns in the digital arena is the consolidation and mergers which is happening in the industry. The question of vetrtical mergers and its consequence on price and competitive effects is an area which require further research and analysis.

India has an elaborate public distribution system which consumes considerable financial resources, manpower and state attention. The efficacy of the present system and how digitilisation can improve its delivery, cost savings need to be researched.

There is also a need to study the impact of digitisation on small coin usage in the country. If digitisation had a profound impact on the economy, small coin usage in the economy should decrease. Besides a study of high "currency" usage in spite of substantial digitalisation also needs further probing.

The impact of smart city initatives in promoting digitisation and beefing up urban infrastrure also requires a detailed examination.

There is also an increasing the research on the consumption needs of the elderly- Gerontrepreneurship Sandhu (2020).

CONCLUSION

India is ranked 48th in overall performance among 63 countries in 2020 by Institute of Management Development (IMD). With a population of 1.3 billion people, of which substantial amount of them below the poverty line India have high digital ambitions. In the digitisation process, creating a digital ID is crucial to the authentication and use of these platforms by households, firms and government. Digital goods are "club" goods – it can be private as well as public good. Aadhaar platform provides authentication services not only for government but also firms and households. Presently it is intensively used by the government and firms and households have scractched the surface of its potential use. Moreover, it creates not only direct externality but also indirect network effects. The GOI taking advantage of the existence of a large cohort of information, communication and technology talent in India had adopted a strategy of "drinking from the rich pool of knowledge workers" and deployed various large-scale digital projects for its governance, payment infrastructure and implementation of welfare programmes. India has the largest global cohort of 820 million youth, which is technology-adaptive and high-productivity, human capital, which could yield a large demographic dividend for prospective potential growth. GOIs' digital initiatives had taken the country from "policy paralysis" to active participation in digital infrastructure so as to set a goal of achieving a "cash lite" economy.

Aadhaar is a major initiative which changed the digital landscape and "game changer" for governance in India and considerably enhanced the "capacity of the state" to deliver welfare programmes efficiently. It facilitated the creation of an "authentication process" of beneficiaries and audit of government service delivery. Based on authentication of Aadhaar card, Government of India has transferred around $45 billion as subsidies to the beneficiaries without any involvement of much involvement of bureaucracy. In total, DBT is now implemented for 1,182 schemes supervised by 75 ministries and government departments. The strategy adopted by GOI called JAM trinity - consisting of Jan Dhan Yojana a bank accounts for everyone, a unique electronic Aadhaar identification, and mobile banking facilitated by unified payment interface (UPI) has made substantial progress and facilitated complementarities between units of JAM. Aadhaar authentication of DBT and banking and payment transactions has considerably reduced the ease and cost of operations of banking and payment services.

In India, the Reserve Bank of India (RBI), has been playing a developmental role in the payment and settlement system by facilitating new digital products and markets. RBI has leveraged the latest technology (UPI) for the benefit of the people and its vision is to empower every Indian with access to a menu of e-payment options that is safe, secure, convenient, quick and affordable.

The recent moves amidst COVID-19 like Digital Health ID, Arogya Setu (contact tracing software) and plans to link family-run Kirana (retail) stores in the rural, semi-urban and urban areas have the potential to further India's digital infrastructure. These high digital ambitions have not compromised cyber security and customer protection. India's future world in digital space includes robotics, artificial intelligence, cloud computing, supply chain 4.0, 3D printing, big data, digital payments, retail, health, education and professional services. India has the talent pool to fructify innovations in these fields.

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ENDNOTES

1 See https://www.thehindu.com/news/national/technology-first-is-our-governance-model-pm-modi/article33131083.ece?homepage=true (Acessed on November 19, 2020).

2 https://www.thehindu.com/news/cities/Coimbatore/pm-kisan-scheme-scam-580-fake-accounts-detected-in-erode-district/article32575965.ece

3 According to MGNREGA rules, the job card can be cancelled if a household has migrated permanently to urban areas; or to a different gram panchayat; or it is proved to be a duplicate; or it has been registered based on forged documents.

4 https://www.trai.gov.in/notifications/press-release/trai-releases-telecom-subscription-data-31st-may-2020 (Acessed on September 11, 2020).

5 See https://www.livemint.com/Technology/ssczejSaUSVHRpaiRgPLYM/Internet-Trends-Report-highlights-Indias-mobile-obsession.html

Chapter 8
Corporate Elderly Entrepreneurship in the Digital World

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ABSTRACT

The purposes of this study are to address elderly entrepreneurship in the context of corporate entrepreneurship, to determine its dimensions, and to make suggestions with the results obtained. The systematic review method was adopted in the study. According to the findings, it has been determined that corporate elderly entrepreneurship includes innovative risk and opportunity management, innovative elderly initiative, innovative proactivity, competition management, and resource management. It is recommended to meet the needs arising due to the social, psychological, cognitive, physical, and health-related decline of elderly consumers through corporate social entrepreneurship. This type of entrepreneurship is an important approach added to the literature to meet the consumer needs that differ with the increasing elderly population. Providing the needs and satisfaction of the elderly is possible with corporate entrepreneurship. Determining the future needs of the elderly living in a nursing home or with their families requires management in innovation.

INTRODUCTION

The world population is gradually increasing, and consumer needs, which vary according to the increasing population, also differ (Harris, 2020). Developing technology, new techniques, increase in the number of production and entrepreneurs have led to competitive price decreases in products and services (Kort, Taboubi, & Zaccour, 2020; Bojkovska et al., 2020). Increasing competition led to significant differences in quality and price in products and services (Choi, 2019). Thus, alternatives for products and services towards the satisfaction and need of consumers are increasing (Kim, Lee, & Lee, 2020; Jeeva & Kumar, 2020; Grant & Philipp, 2020). The increase in alternatives also differentiated entrepreneurial behaviors

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significantly due to the increase in the number of entrepreneurs in products and services (James et al., 2020; Raza, Muffatto, & Saeed, 2019).

Entrepreneurship behavior goes beyond the current needs of consumers and is directed towards future needs (Perry et al., 2017). Internet networks and technology increase the satisfaction level of consumers and enable the interaction of businesses with consumers in different geographies (Mayer & Leick, 2019; Yen, 2005; Evans et al., 2001; Hennig-Thurau et al., 2004; Liu et al., 2020). High-speed trains, air, and sea transportation are also improved, so consumers get the product they demand to purchase quickly. This rapid change and development increased the competition and differentiated the needs of the consumers. On the other hand, the increasing elderly population caused differentiation of the consumer mass (Gilly & Zeithaml, 1985; Wang, Hu, & Li, 2016).

The increase in the elderly population paved the way for new initiatives and businesses and individuals approach this population increase as an important opportunity (Backman, Karlsson, & Kekezi, 2019; Fritsch, Sorgner, & Wyrwich, 2019). Thus, elderly entrepreneurship has emerged. The foundations of elderly entrepreneurship arise from differences in the physical, social, cognitive, psychological, and health needs of older individuals (Maâoui, 2019). Initiatives linked to innovations in the field of geriatrics and gerontology can be given as examples (Schiavone, Dezi, & Leone, 2019). Innovative product and service requirements regarding aged care, treatment of aging diseases, aging-related declines can be satisfactory via entrepreneurs (Colovic, Lamotte, & Bayon, 2019; Backman, Karlsson, & Kekezi, 2019). Elderly people, who started to move away from social life, experience memory problems, are abandoned by their families, and need care because of social isolation (Tasheva et al., 2020; Clark et al., 2020; de Morais Fabrício, Chagas, & Diniz, 2020). The health problems posed by the aging process require the care of elderly individuals at home or in the hospital (Patty, Elkhuizen, & Huijsman, 2019; Paul et al., 2019; Adıgüzel & Acar-Tek, 2019). However, the execution of all these services can be more satisfying with innovative actions. In this case, elderly entrepreneurship is an important process that provides the satisfaction of elderly individuals with their consumption-based needs and requires innovative and creative processes and actions in products, services, and processes for future needs (Ting, 2008; Stough, 2016). The high-aged population of developed countries has the biggest share in the emergence of this type of entrepreneurship (Muramatsu & Akiyama, 2011; Park et al., 2014). On the other hand, the increase in the elderly population, especially in developing countries, raises the issue that policymakers should take some measures in terms of meeting consumer needs (Mitchell, 2016; Coole, 2012; McCracken, 1987; Piekut, 2020; Bai & Lei, 2020). For this reason, it has become necessary to address entrepreneurship in the context of aging and corporate entrepreneurship, which is the current subject of today.

The purpose of this study is to address elderly entrepreneurship in the context of corporate enterprise, to determine its dimensions, and to make suggestions with the results obtained. The study was carried out by a systematic literature review. The target audiences of the study are the fields of business, entrepreneurship, innovation, management, aging, gerontology, geriatrics, and gerontechnology.

CONCEPTUAL FRAMEWORK

Corporate Entrepreneurship

Corporate entrepreneurship is a type of entrepreneurship consisting of new business ventures, innovation, continuous competitiveness, and proactivity (Hampel, Perkmann, & Phillips, 2020). Organizations

need institutional restructuring to gain a competitive advantage in the international and national markets, improve performance and efficiency, and improve their strategic growth capabilities (Niemann, Dickel, & Eckardt, 2020). In corporate entrepreneurship, it is not sufficient to develop a strategy to ensure the emergence and management of innovation within the organization (Gurău & Dana, 2020; Bui, Nguyen, & Chau, 2020). Adaptation to the internal and external environment is necessary for a sustainable competitive advantage by determining the risks beforehand and evaluating the opportunities before the competitors (Kumar & Kumar, 2020; Fis & Cetindamar, 2020). This entrepreneurial element, which is stated as aggressive competitiveness in the literature, has been put forward due to the intensity of competition (Dapper, 2019).

Corporate entrepreneurship involves the realization of new ventures, businesses, processes, strategies, products, and services (Astrini et al., 2020). Collective innovative behaviors for self-renewal, financial performance, and competitiveness are the precursors of this type of entrepreneurship (Setiawan & Erdogan, 2020). For this reason, corporate entrepreneurship is a type of entrepreneurship that is carried out at the level of the organization, but the basic building blocks of the organization are mobilized for the total benefit (Abdulrahaman & Garba, 2020). Businesses/entrepreneurs desire to grow by increasing their market share, internationalize, and increase their cash flow and profitability. Ensuring their sustainability is possible by maintaining its competitive power in the market. The development of competitors, technology, and new techniques in the market provides an important competitive advantage or disadvantage (Aina & Solikin, 2020). Businesses that benefit from the emerging opportunities by acting early than competitors also gain a competitive advantage (Nguyen & Pham, 2020). On the other hand, taking measures against risks and threats and performing these measures with proactive behavior ensures that the business is protected from possible losses (He & Ma, 2020). These protection measures are necessary and important for the sustainability of the business (Malliga & Naganandini, 2020). However, the most important sustainability factor is renewal.

Renewal is an important factor for the business to gain a sustainable competitive advantage (Provasnek et al., 2017; Geradts & Bocken, 2019). The company's self-renewal is possible with innovation. Innovative actions that take place in the entire organizational network, from employees to infrastructure, organizational units, managers and leaders, stakeholders, make the organization sustainable (Fischer & Kuhn, 2017). The inclusion of these actions in the organization's strategy and their cooperation ensures the formation of corporate entrepreneurship. Entrepreneurship is an action to anticipate threats and risks with proactive behavior, take necessary measures, turn opportunities into benefits, and ensure sustainability with new technology, processes, markets, products, and targets (Kadir et al., 2018). Transforming these actions into a corporate structure reveals corporate entrepreneurship. The fact that entrepreneurship is multidimensional and concerns different disciplines increases the importance of corporate entrepreneurship (Wagner, 2017). Entrepreneurial behaviors of businesses are related to many fields such as medicine, psychology, business administration, law, and sociology. One of these fields is aging.

Aging is one of the current issues that arise in the increasing world population. The increasing importance of this current issue is due to the solution of the problems of the increasing elderly population (Salehi et al., 2020). The increase in the longevity rate and the decrease in the mortality rate revealed important consumption and satisfaction problems (Friedman, 2019; Rousseau, 2018). The needs arising due to the physical, social, cognitive, and psychological decline of older individuals are gradually increasing. Changing innovations in technology and medicine are not enough to meet the needs of the growing elderly population. This situation raised the issue of elderly entrepreneurship.

Elderly Entrepreneurship

Elderly entrepreneurship is a type of entrepreneurship that covers the needs of the elderly, satisfying the consumption of elderly people, producing products and services suitable for the interests and needs of the elderly, creating new processes, and creating innovative ideas (Colovic, Lamotte, & Bayon, 2019).

In the aging process, people experience physical declines and need gerontechnology and assistive technology (Giordani & Cinelli, 2018). These products and tools contribute to the active participation of the individual in life (Pinto-Bruno et al., 2017). Devices reminding the medication period for individuals with memory problems, devices used in-home care services, smartphones, wheelchairs, medical devices and vehicles for individuals who need care due to a decline in their physical functions are some of the important innovations that connect the individual to the life (Cahill, McLoughlin, & Wetherall, 2018; Baez et al., 2019; Yusif, Soar, & Hafeez-Baig, 2016). These devices and tools, which are revealed with the developing technology and new techniques, meet the needs of the elderly. Entrepreneurship is to identify these needs by transforming them into innovative actions by acting early than their competitors by the business or organization and to carry out production and service-based activities by taking the necessary risks.

Increasing the needs of the elderly population and elderly individuals is an important opportunity and also a risk for businesses (Kusano, Wright, & Conger, 2016). It is possible to turn the risks undertaken into benefits with entrepreneurship. The entrepreneur identifies these needs of older individuals and provides action before their competitors. Increasing competitiveness and satisfaction level necessitates the development of the companies regarding entrepreneurship.

In the literature, elderly entrepreneurship is explained in the same meaning as senior entrepreneurship (Pilkova, Holienka, & Rehak, 2014). Senior entrepreneurship is about entrepreneurial actions of post-retirement or elderly individuals (Isele & Rogoff, 2014). In this type of entrepreneurship, entrepreneurs are older individuals (Maritz, 2015). However, in elderly entrepreneurship, the entrepreneur can be an elderly or a young individual. The essential feature of Elderly entrepreneurship is that innovations are directed towards the consumption needs of the elderly. However, senior entrepreneurship includes the creative and innovative actions of the elderly individual (Cervený, Pilcová, & Rehák, 2016; Duhamel, Erogul, & St-Jean, 2016). Revealing entrepreneurship ideas of the elderly may require supporting the individual. On the other hand, it is not the entrepreneur supported in entrepreneurship, but the idea of entrepreneurship. Because elderly entrepreneurship is aimed at meeting the needs of elderly individuals who are minority consumers.

RESEARCH METODOLOGY

This study was prepared by a systematic review method including the analysis and synthesis of qualitative and quantitative data, one of the qualitative research methods. Identification, review and research, classification and data analysis, summarization, extracting data, discussion, and presentation processes were followed respectively. Following the purpose of the study, first of all, the research question was determined as follows: What is corporate elderly entrepreneurship and what are its dimensions?

The scope of the subject was limited to be examined in the context of this research question. Depending on the framework determined within the scope of the research question, the key concepts of corporate entrepreneurship, elderly entrepreneurship, elderly consumer, elderly consumption, senior entrepreneur-

ship, and digital enterprise were determined (Petticrew & Roberts, 2008). The keywords and concepts were searched on the Web of Science and Google Scholar databases. The obtained articles were classified according to the framework determined by reading. During the classification, senior entrepreneurship and elderly entrepreneurship were determined to be different concepts (Kitchenham & Brereton, 2013). Thus, after the obtained data were summarized, the data out of the scope was extracted from the study (extracting data). Topics emerging as a result of the excluded data were rearranged (Komba & Lwoga, 2020). The results were discussed and the information/knowledge presented under the title was evaluated. Finally, related topics were presented in the article under the titles and subtitles.

CORPORATE ELDERLY ENTREPRENEURSHIP

Corporate elderly entrepreneurship is a type of entrepreneurship that intrapreneurs are taken under control and strategically directed, innovative actions are taken to meet the needs arising in the aging process, risks are converted into benefits by undertaking risks related to aging, follow-up of the aging process and the activities aimed at eliminating the deficiencies based on satisfaction arising in this process. (Hisrich, 1990). Transformation of elderly entrepreneurship into a corporate structure is possible with proactive behavior, innovative elderly initiative, competitiveness, risk-taking and distributing resources to innovative actions, and strategic innovation management (figure 1).

Figure 1. Corporate elderly entrepreneurship dimensions

Innovative Risk and Opportunity Management

Risk is the possibility regarding hazard, unexpected situation, probability of damage or harm, uncertainty, encountering negative results, and financial losses. Risk is a concept related to probability and

uncertainty. Because of these negative possibilities, when businesses encounter risks, they focus on loss rather than benefit as a result of these risks. If the benefits to be obtained as a result of undertaking the risks are lower than losses, the risks are avoided. However, it may not always be possible to realize this prediction. In such a case, very few enterprises will have the benefit to be obtained by undertaking the risks. Because risk is a possible loss and also an opportunity. Therefore, it is necessary to manage risks and opportunities (Stopford & Baden - Fuller, 1994).

The aging process involves significant risks in the context of consumption and entrepreneurship. The needs of each elderly, which differ according to their socio-demographic features, health, psychological, and pathological conditions, also affect their consumption tendency and behavior (Bassuk, Glass, & Berkman, 1999). Declines caused by diseases and physical disabilities increase the dependence of elderly individuals on assistive technologies and gerontechnological devices (Mann et al., 1999). However, the production of devices that are suitable for each individual's needs raises an important entrepreneurship problem. On the other hand, it is an important risk factor that the services offered to the elderly individuals living with their families differ according to the families' demands. Undertaking these risks can provide significant benefits for businesses that manufacture these products and offer services. Besides, the low population of the elderly compared to other consumers is another risk factor. The benefit to be achieved via mass production may be low in the context of the elderly (Bögenhold, 2000). Making existing technological devices suitable for the elderly may present usage difficulties due to age discrimination and low intergenerational communication (Knodel & Chayovan, 2008). This may cause a reduction in consumption and different risks in entering the new market. Problems that may arise due to the ability of the elderly to grasp, especially in product diversification, assembly, and support are among the possible risks (Jorge, 2001). On the other hand, the entrepreneurial successes to be achieved in these issues, which are considered as risks by the majority of the enterprises, can increase the competitiveness and provide a significant level of profitability.

Use habits are an important risk for elderly individuals and families of the elderly in-home care services (Clancy, 1975; Wang, 2020). Ease of use of the products that form the basis of the entrepreneurship action, ergonomics, compliance with cultural requirements, suitability for use, and the price are effective on the product use of the elderly (Dutta, Bhardwaj, & Rathore, 2019; Mazlomi, Hajizadeh, & Feyzi, 2019). Besides, social factors such as family, friends, and neighbors have an impact on the technology use of the elderly (Meng et al., 2020; Talukder et al., 2020). It should be anticipated by executives/entrepreneurs of the businesses that these effects may differ according to cultures and health conditions. Any unforeseen risk can result in possible losses.

Innovative Elderly Initiative

The innovative elderly initiative includes the aging process and initiative actions to satisfy the consumption needs of older individuals. Men and women may have different needs in this context. The aging process in women includes various functional differences compared to men (Sieck, 2018). For instance, the result of the menstruation period with menopause creates psychological and emotional differentiation (Harlow, 2018). The instinct to protect their children, especially mothers, may differentiate their consumption needs. While men focus on consumption needs in financial matters, women focus on food, clothing, and cosmetics needs. Cellulite, crow's foot, wrinkles, and weight problems that appear with aging lead women to meet their needs in fitness, sports, and medical fields. Men, on the other hand, tend to consumer preferences such as hair care, clothing, and technological tools. Despite these consumption

differences, males and females have common needs in the context of medical needs and gerontechnological devices (Gutman et al., 2018).

Gerontechnology is a discipline consisting of a combination of gerontology and technology, aimed at the technological needs of the elderly (Kwon, 2016). This multidisciplinary field includes studies to eliminate the negative effects of the aging-related decline on the individual's use of technological devices. Ergonomics (medical devices, orthopedic devices, etc.), improvements to overcome psychological weaknesses (teleconferencing, e-therapy, smartphone applications, social media, e-services, etc.), improvements to compensate for forgetfulness and cognitive decline (reminder wristwatches, smartphone apps, etc.), facilitating active participation in the life, which is prevented by physical declines (Electronic POP Displays, patient lifts, smart stairs, smart home systems, smartphone applications, social media, online shopping sites, e-services, etc.), security, technological devices applied in the home care services (mobile tracking systems, emergency device, smartphone applications) are related to the gerontechnological devices.

It is important for entrepreneurial enterprises and owners regarding which features of these devices make difference in the needs of elderly individuals, the level of meeting the needs of elderly individuals by gerontechnological devices (Özsungur, 2019). It is possible to demonstrate the entrepreneurship action in the context of product, service, and process.

Innovative Proactivity

Proactive behavior is beyond the act of reacting to the occurrence of an event. This behavior involves taking action before the event takes place and taking on possible risks (Park & Jo, 2018). For this reason, proactive behavior includes taking risks, taking initiative, control, and sensitivity. A proactive entrepreneur follows the events that develop around her/him, controls the risks, behaves early than her/his competitors in the evaluation of opportunities, evaluates the cost/possibilities, and makes a quick decision (Hu et al., 2018). In addition to the positive outcomes of proactivity such as sustainability, competitive advantage and profitability in the market, negative outcomes such as loss, failure to gain the foreseen benefit, and turning risks into threats may occur (Garay, Font, & Pereira-Moliner, 2017). Therefore, there is a need for a strategic management system in proactivity.

The entrepreneur should identify the risks, possible threats, and possibilities that s/he will assume before demonstrating her/his proactive behavior. This determination should be related to the entrepreneur's field of activity. Any risk undertaken outside the field of activity may result in loss. In elderly entrepreneurship, innovations in gerontology, social work, geriatrics should be related to the entrepreneur's field of activity. The entrepreneur is under an important risk in entrepreneurial actions that h/she will carry out outside her/his field of activity. For instance, when an entrepreneur operating regarding the field of medical devices takes risk of geriatric devices, the gained benefit may be lower than the expected benefit. Success, in this case, may depend on the execution of the project by the experts, detailed analysis, and infrastructure provision. Especially entrepreneurs operating in the manufacturing sector bear significant costs in terms of changes to the production line (Chen, Chen, & Lin, 2016). If the cost incurred does not turn into benefits in the short term, the enterprise faces loss. In innovative actions in the context of the service, the entrepreneur should conduct the necessary research on older consumers to provide new services.

Innovative proactivity is based on innovation in the proactive behavior of the entrepreneur. Actions that provide innovation to the consumer, produce an innovative product, or provide services are among such

proactive behaviors (Escrig-Tena et al., 2018). Innovative proactivity actions in elderly entrepreneurship include determining the needs of the elderly for technological products or services before competitors, determining the possible risks through benefit/cost analysis, adopting innovative methods and techniques, implementing innovative processes (Lim & Han, 2018; Ehn, Johansson, & Revenäs, 2019).

Competition Management

Competition is the struggle and conflict regarding superiority in a certain area. This struggle and conflict are carried out to be permanent in a medium or system, to demonstrate and reveal itself. Competition in entrepreneurship is put forward to ensure that innovative actions can be superior to competitors. The entrepreneur performs competitive management for ensuring the sustainability of her/his business, increasing her/his market share, developing a growth strategy, gaining new customers, profitability, and efficiency (Amir, Auzair, & Amiruddin, 2016). Competition in entrepreneurship is not a simple struggle or conflict. Competition is being aware of the competitors and the market, the needs of customers and consumers, performing the necessary research on products and services, evaluating the opportunities in technology and new techniques (Kulikowska-Pawlak, Bratnicka-Myśliwiec, & Ingram, 2017). On the other hand, competition management is the execution of these actions in a process (Staniewski, Nowacki, & Awruk, 2016).

The importance of competition management related to elderly entrepreneurship emerges in the context of meeting the needs of the elderly (Maillé, Éthier, & Beaulieu, 2019). Identification of competitors meeting the needs is important in providing products and services such as medical products and services, home care services, smartphones (Plöthner et al., 2019). On the other hand, if the number of enterprises meeting the needs in the market is high compared to the elderly population, the enterprise may lose its competitive power. In this case, the entrepreneur can make a competitive management strategy with innovative products and services that appeal to the elderly population. The entrepreneur (elderly entrepreneurship) can make innovative changes to the product or service produced in the market, or create new products or services and gain competitors' customers. This competition aims to predict the trend of elderly needs for the management strategy. For this reason, the tendency of elderly consumers regarding new products and services should be determined early than the competitors.

Resource Management

The resource is the sum of available or ready-to-use components that make an organization functional (Courpasson, Dany, & Martí, 2016). Resources are the basic building blocks of an organization's sustainability. Fulfilling the multi-faceted functions of the organization such as meeting the needs, supply, sales, marketing, logistics, service depends on the management of the distribution and supply of these resources (Nyameboame & Haddud, 2017). Resource supply requires the use of internal and external resources to perform organizational functions (Damanpour, Magelssen, & Walker, 2019). Similarly, the creation of new products and services in entrepreneurship, the establishment of new businesses, and the revision of processes depend on resource management.

The fact that entrepreneurs make innovative initiatives for the needs of the elderly can lead to outsourcing. The necessity of capital for new enterprises leads the entrepreneur to obtain financial resources (Kjellström, 2019). Financial resources are obtained through credit institutions, banks, family, spouse, friend, angel investor, government incentives, non-governmental organizations. Access to these resources

requires an important management process. It is necessary to establish new enterprises to meet the basic requirements such as the supply of the raw material of the product to be produced, the processing of the raw material, the technological infrastructure, distribution of the products, after-sales services and employee wages (Bals & Turkulainen, 2017). Financial resources are necessary for expenditures that require tax liability such as export, import, value-added tax during the establishment phase of the business. Certification costs for the manufactured products are also included in these costs.

Resource management in elderly entrepreneurship should be implemented in creating innovative products or services for elderly consumer needs, introducing new processes, or establishing new businesses. The need for elderly care homes or nursing homes due to government policies can be turned into opportunities by entrepreneurs. The support given by the state or public authorities to the elderly entrepreneurship should be taken into consideration in these entrepreneurship actions. Entrepreneurship supports given to small and medium-sized companies, support, and financial resources provided for women entrepreneurs are important resources for elderly entrepreneurship (Suresh & Indira, 2018). Tax reductions and government subsidies should be put forward as a project in the export of medical devices and technological devices for the elderly. On the other hand, performing resource management following entrepreneurial goals and objectives provides profitability, efficiency, competitive advantage, and sustainability (Lok, Opoku, & Baldry, 2018).

In resource management, the distribution of resources should be performed following the purpose of the enterprise. Innovative actions in activities to be carried out in the nursing homes for the social adaptation of the elderly can provide an important competitive advantage. The resources to be provided for the activities should be distributed according to suitable goals and period (Levinthal, 2017). Expenditures for advertisement, promotion, hall rent, social media should be distributed in a balanced way. Entrepreneurship action to start up a nursing home in societies where it is not considered culturally appropriate for older individuals to be separated from their families may lead to a waste of resources (Klochko, Britikova, & Kovalenko, 2019). On the other hand, entrepreneurship to be realized within the scope of social responsibility projects ensures the sustainability of the business to be established. Excessive costs in promotional activities can lead to a waste of resources. On the other hand, innovative applications or devices added to smartphones for the elderly should be commensurate with the purchasing power of elderly consumers. An imbalance that may arise can cause damage to the sales of manufactured products.

DIGITAL ENTERPRISE

The service and production sector has introduced a developing digital enterprise model thanks to developing technology and digital innovations (Sandhu, 2008). This model is a digital enterprise. Increasing competition and internet network-based customer needs, push entrepreneurs towards this field. It is a type of enterprise where digital enterprise information and communication technology is used effectively, design and planning are carried out in accordance with digital resources and customers, services are revealed through digital resources (Brusakova & Shepelev, 2016). In this type of enterprise, engineering, technology, design, and marketing are realized by applying digital innovations.

The Internet of things (IoT) has revolutionized the connection/link between mechanics, machinery, and people. This system, which can activate the mechanical functions of digital devices with the help of a network of data, has increased the efficiency of the service and production sector and has become an important indicator of competitiveness (Sandhu & Corbitt, 2002). Smartphones, smart home systems,

devices operating with remote control have emerged via this technology. This technology has increased human control and management effectiveness on digital machines (Lee & Lee, 2015). On the other hand, the functionalization of data exchange has developed entrepreneurial ideas thanks to virtual networks. Digital businesses have been started up in this way and provided to meet the needs of customers. Especially in extraordinary situations such as a pandemic, this enterprise model has become more prominent.

IoT provides significant benefits to individuals with declines in the physical and health context through the creation of the virtual network. Besides, this technology has revealed some virtual innovations. Virtual reality technology provides a simulated experience for consumers in entertainment and education enterprises (Passerini, El Tarabishy, & Patten, 2012; Burdea & Coiffet, 2003). Mixed reality, on the other hand, is a technology where the virtual and real-world is presented to consumers together (Ohta & Tamura, 2014). Augmented reality is a virtual combination of real-world experiences with a method that can affect the four senses (olfactory, somatosensory, auditory, haptic, visual) of individuals (Carmigniani et al., 2011). All these technological and digital innovations are applied to increase the satisfaction of consumers concerning products and services. These methods, which were first applied for the entertainment sector, are applied in different sectors such as education and tourism today. In the manufacturing sector, the Industrial Internet of Things (IIoT) has been implemented. Machine-to-machine (M2M) communication is applied for IoT to provide efficiency and improvement in industrial applications (Munirathinam, 2020). Especially in the supply chain, this technology provides significant benefits to provide time, performance, and efficiency outputs. Network-based control systems such as operational technology, information technology, human-machine interfaces (HMIs), supervisory control, and data acquisition (SCADA) in the manufacturing sector form the basis of IIoT. Smart sensors, computer-based control systems, actuators, and other digital systems provide the entrepreneur with the necessary information for "decision-making" (Upadhyay & Sampalli, 2020; Caiza et al., 2020).

A digital enterprise is an initiative that closely follows the latest developments required by digital innovations. These initiatives are performed with the necessary initiatives and actions to bring the infrastructure required by digital transformation into operation. In this type of enterprise; risk-taking, seeking opportunities, and innovation management are performed according to digital requirements (Maropoulos et al., 2007).

Digital Mapping and Network

The functional organizational structure, digital resources, capital, financial data, and archive of the enterprise are clarified through digital mapping. Key processes of the business are revealed through Information and Communication Technology (Uhl & Gollenia, 2016). Thus, possible threatens, risks, unrelated processes, factors causing obstructions can be determined. Data management and the development of new initiatives depend on this map. In addition, this technique helps to draw a visual and virtual business profile (Monostori et al., 2010).

A digital network is required in a digital enterprise. Digital devices must be compatible with each other through IoT. This network provides the connection of data between digitally integrated devices. It is also important for the transformation of data. Data can be used in different processes depending on the data obtained with mapping. Feedback from customers, or business' financial data can cause a data transformation to be used in new enterprises or processes of the business.

Digital Enterprise Transformation Management

Businesses need digital enterprise transformation management to adapt to the requirements of the digital world, to meet the expectations of customers, to contribute to the sustainability of digital innovations in extraordinary situations, for competitiveness and promotion (Skilton, 2016). This form of management involves harmonizing the resources, organizational structure, processes of enterprises established with the entrepreneurship model with digital requirements. This transformation requires a revolutionary process in business, a creative strategy beyond existing innovations. Financial data, logistics, and operation, procurement and production, sales and marketing, after-sales services, customer service, public relations are affected by this transformation management (Uhl et al., 2016).

Digital transformation requires a strategy and adaptation process. Therefore, the resources, organizational structure, and technological infrastructure of the enterprise should be considered. Harmonization of the process depends on the integration of digital and mechanical infrastructure with information and communication technology. Therefore, it should be checked whether the existing resources of the enterprise are compatible with IoT and IIoT. Besides, digital transformation in the manufacturing and service sector requires different resources and strategies (Sandhu & Corbitt, 2018). Computer-based, visual, and audio technologies can gain weight for customers in the service sector (Sandhu & Corbitt, 2008). On the other hand, the same requirements may arise in the manufacturing sector. Therefore, the application of interference models through the enterprise may require the simulation method. Simulation provides crucial predictions in the application and transformation of digital technology to the enterprise model (Rouse, 2005). Design and modeling, financial outputs, risks and threats, process management, determination of distribution channels, profitability, and efficiency predictions are provided by simulation. For this reason, simulation should be used while forming a strategy.

Digital Enterprise and Corporate Elderly Entrepreneurship

Corporate elderly entrepreneurship, besides being a type of entrepreneurship focusing on the needs of elderly individuals, emphasizes the corporate structure. Institutionalization requires that the organizational structure is strong and competitive. In particular, the requirements of environmental changes and extraordinary situations necessitate the initiatives to be put under an institutional structure. The risks posed by the COVID-19 pandemic, which became widespread in 2020, led to the emergence of new enterprises. The age group most affected by the pandemic is 60 years old and older. This situation has caused social isolation for individuals in this age group that has physical, psychological, and health declines. However, digital enterprise and innovations in the digital field transform this situation into an opportunity and realize the initiatives required especially for assistive technology (Konno & Iijima, 2019).

Digital enterprise reveals important transformations in the field of health. Blockchain electronic health records, artificial intelligence, telemedicine, smart devices, sensor applications have provided important innovations in the field of geriatrics and health improvement (Guo et al., 2018; Hu et al., 1999; Graafmans, 1998). On the other hand, although virtual shopping restricts the active lives of elderly individuals, they protect against possible viruses and disease threats. Video conferencing, IoT, smartphones ensure the sustainability of the social and family relations of the elderly. Smart home systems help to overcome the shortcomings caused by the physical and cognitive decline of the elderly. The service that is most affected by the digital enterprise is home care services. The home care personnel can control

the elderly individual through digital devices, and the cognitive and mental status of the individual can be determined through video conferencing (Abdi et al., 2018).

These developments in the digital field are gradually increasing, and the needs of elderly consumers continue to vary accordingly. For this reason, the digital enterprise has entered into a corporate transformation that will meet the needs of elderly individuals in a digital context. Considering the situations of limiting the relations of the elderly with the external environment, virtual, mixed, and augmented reality technologies should be taken into consideration in meeting the consumption needs. Digital transformation is an important assistive technological factor in meeting the needs of elderly consumers (Miskelly, 2001). For this reason, the elderly needs arising with the developing technology should be taken into consideration by entrepreneurs in a digital context.

SOLUTIONS AND RECOMMENDATIONS

Companies that manufacture medical devices, nursing homes, companies that provide home care services, social media, and web provider companies should predict and research the consumption trends and needs of the elderly. In these determinations, the ideas and trends of the households where elderly consumers live together should be taken into consideration. The information obtained should be handled in the context of risks and opportunities. The entrepreneur is included in the process with a specific management understanding by making an opportunity/benefit/cost analysis. Entrepreneurship actions are determined by taking into consideration the characteristics of the elderly such as gender, family, socio-cultural, physical, health, and psychological. In the entrepreneurial behavior to be put forward, proactive behaviors are performed and competitive advantage is achieved. Entrepreneurship behavior requires obtaining and distributing resources in carrying out this process. Thus, elderly entrepreneurship becomes corporate entrepreneurship by realizing this process under the purpose of the organization. The transformation of elderly entrepreneurship into a corporate structure is possible by following this process. Supporting the subject with empirical studies will contribute to the literature.

FUTURE RESEARCH DIRECTIONS

It is recommended in the context of future studies to develop a scale for corporate elderly entrepreneurship and to increase qualitative and quantitative research on this issue. Consumption trends of the elderly should be evaluated in the context of corporate entrepreneurship. Future studies should also address cultural differences for this new type of entrepreneurship. On the other hand, elderly people living in nursing homes, palliative elderly, gerontechnological devices, technology-elderly interaction should be highlighted in these studies.

CONCLUSION

Elderly entrepreneurship has been researched in the context of economics (Ting, 2008; Pilkova, Holienka, & Rehak, 2014), public sector service entrepreneurship (Windrum & Koch, 2008), social entrepreneurship (Wong & Tang, 2006), and senior entrepreneurship (de Bruin & Firkin, 2003). Other studies are

related to entrepreneurship actions of the elderly after retirement (Jamil, Nasah, & Hassan, 2014; Weber & Schaper, 2004; Gimmon, Yitshaki, & Hantman, 2018; Pilková & Rehák, 2017). However, corporate entrepreneurship in the elderly has not been investigated in the literature. This study is the first to bring elderly corporate entrepreneurship into the literature. However, the fact that it is not based on empirical findings constitutes the limitation of the study.

According to the findings of the study, elderly entrepreneurship has been added to the literature to meet the needs of the elderly regarding products and services. Entrepreneurship for products and services that provide support for the elderly physically, socially, psychologically, and cognitively requires a process to be managed. Corporate entrepreneurship comes to the forefront in the execution of the managerial process of this entrepreneurship. Corporate elderly entrepreneurship includes innovative risk and opportunity management, innovative elderly initiative, innovative proactivity, competition management, and resource management. According to these findings obtained through a systematic literature review, meeting the increasing needs of the elderly depends on corporate entrepreneurship. Therefore, the development of corporate elderly entrepreneurship is important to meet the needs of the growing elderly population. It is recommended that the necessary incentives be provided by governments and non-governmental organizations. Improving elderly entrepreneurship is important for businesses to meet the needs of elderly individuals. Although the increase in the elderly population is an opportunity for entrepreneurs, different levels of satisfaction and needs of elderly consumers pose a risk. Observing these risks, evaluating opportunities, introducing innovation in products and services, start-up new businesses for the elderly make corporate entrepreneurship necessary.

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KEY TERMS AND DEFINITIONS

Augmented Reality: A virtual combination of real-world experiences with a method that can affect the four senses.

Competition Management: The execution of being aware of the competitors and the market, the needs of customers and consumers, performing the necessary research on products and services, evaluating the opportunities in technology and new techniques in a process.

Corporate Elderly Entrepreneurship: A type of entrepreneurship that intrapreneurs are taken under control and strategically directed, innovative actions are taken to meet the needs arising in the aging process, risks are converted into benefits by undertaking risks related to aging, follow-up of the aging process and the activities aimed at eliminating the deficiencies based on satisfaction arising in this process.

Corporate Entrepreneurship: A type of entrepreneurship consisting of new business ventures, innovation, continuous competitiveness, and proactivity.

Digital Enterprise: A type of enterprise where digital enterprise information and communication technology is used effectively, design and planning are carried out in accordance with digital resources and customers, services are revealed through digital resources.

Digital Enterprise Transformation Management: A management-type harmonizing the resources, organizational structure, processes of enterprises established with the entrepreneurship model with digital requirements.

Elderly Entrepreneurship: A type of entrepreneurship that covers the needs of the elderly, satisfying the consumption of elderly people, producing products and services suitable for the interests and needs of the elderly, creating new processes, and creating innovative ideas.

Innovative Elderly Initiative: Innovation activities to meet the needs of the elderly.

Innovative Proactivity: Innovation in the proactive behavior of the entrepreneur.

Mixed Reality: A technology where the virtual and real-world is presented to consumers together.

Resource Management: A management type of the sum of available or ready-to-use components that make an organization functional.

Virtual Reality: A simulated experience for consumers in entertainment and education enterprises.

Chapter 9
Digital Business Transformations:
An Investigation About Business-Driven and Technology-Enabled Strategies

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ABSTRACT

This chapter is designed with the aim of analyzing digital business transformations (i.e., digital transformations that companies decide to start in order to respond to market changes). Nowadays, these changes are due to the affirmation of a new paradigm of doing business that is strongly characterized by the role of information and communications technologies (ICT) and information and communication infrastructures (ICI). This has led to the point that digital business transformations are increasingly being considered as a topic exclusively related to information technology and engineering fields of research. In contrast with the above promise, the present research aims to investigate digital business transformations according to a managerial perspective that is often sacrificed in practice. The preponderant role of technologies often leads—in an incorrect way—to neglect the basic concepts of management that, on the other hand, persist in change and, indeed, constitute the backbone of change itself.

INTRODUCTION

This chapter is designed with the aim of analyzing management and strategies of digital enterprise transformation, i.e. digital transformations that many companies decide to start proactively (to try to anticipate market changes) or reactively (to respond to market changes). Nowadays, market changes are due to the affirmation of a new paradigm of doing business that is strongly characterized by the role of new technologies (Carlsson, 2004; Glas & Kleemann, 2016). The affirmation of Information and Communications Technologies - ICT and Information and Communication Infrastructures - ICI is undeniable, just as it is indisputable the role that technologies and infrastructures have assumed in digital strategic

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planning processes, i.e. digital strategizing (Chanias et al, 2019; Warner & Wäger, 2019; Peter et al, 2020). This has led to the point that digital business transformations are increasingly being considered as a topic exclusively related to information technology and engineering fields of research (this is the research gap emerging from an extensive literature review).

In contrast with the above promise, the present research aims to investigate digital business transformations according to a managerial perspective that is often sacrificed in practice. The preponderant role that technologies are assuming often leads – in an incorrect way – to neglect the basic concepts of management that, on the other hand, persist in change and, indeed, constitute the backbone of change itself. In this vein, it is appropriate to keep in mind that companies are born with business strategies and that digital strategies (i.e. the strategic approach to digitization plans of companies) can enrich or complete them. For this reason, without aiming to question the key role of technologies and infrastructures and the continuous advances they achieve (Nambisan et al, 2017; Furr & Shipilov, 2019), the research question at the basis of this chapter sets out to investigate and recognize the value of the discipline of management in digital business transformations.

In this sense, throughout the chapter, it will be reiterated the idea that management of digital enterprise transformations are business-driven and technology-enabled processes that arise with a managerial connotation and feeds on concepts and theories typical of management studies. Technologies assume the key role of promoting their application and maximizing their efficiency. It does not sound correct to think that digital age is transforming the way of doing business, from a managerial to a technological perspective (Ayres & Williams, 2004; Ross et al, 2016; Quinton & Simkin, 2017; Sebastian et al, 2017; Ivančić et al, 2019; Nambisan et al, 2019; Tabrizi et al, 2019; Vial, 2019).

More specifically, by recalling the basic concepts of management discipline, it is appropriate to underline that the choices made by the companies, the plans they define and the actions they implement are – and, actually, they are going to be – choices that fall within the management filed of research. For this reason it can easily be argued that the digital transformation process is a business-driven process. At the same time, it is undeniable that technologies play a key role; however, it should be clarified, the key role is to accelerate, encourage and support these choices, these plans and actions without ever influencing the basic choices that (it is appropriate to repeat it once again) fall within the management discipline. For this reason it can be concluded that digital business transformations are technology-enabled processes.

In order to illustrate the reasons that led to define digital business transformations as business-driven and technology-enabled processes, it is going to be proposed a careful re-reading and an in-depth analysis of digital business transformations that, from a strategic point of view, can be oriented towards customer engagement or digitalized solutions. Both objectives entail one or more changes in the value creation process for which companies need to define their digital strategizing process and – before that – they need to proceed with a S.W.O.T. analysis. Accordingly, it results that digital business transformations are business-driven and technology-enabled processes. Practical cases, such as LEGO, Apple, McDonald's and Rowenta clearly show this.

Because of the investigated topic, the chapter has important implications for management scholars, policy makers and practitioners. Management scholars are invited to underline the importance of business-driven and technology-enabled processes, strengthening the role of management issues in digital business transformations.

Recognizing that digital business transformations are business-driven and technology-enabled processes is of fundamental importance also for policy makers who, very often, have the task of defining and implementing useful measures to support ongoing and new businesses in digital age.

At the same time, recognizing that digital business transformations are business-driven and technology-enabled processes is of fundamental importance for practitioners (entrepreneurs and managers) who personally define and implement new digital business transformations.

THE MAIN GOALS OF DIGITAL BUSINESS TRANSFORMATIONS

Through strategies for digital enterprise transformation companies can try to pursue two main strategic objectives (Ross et al, 2016; Sebastian et al, 2017) that are customer engagement and digitized solutions. In the case of customer engagement, companies aim to change their approach to the market by involving their customers (real and/or potential) more assiduously and with stronger bonds, so as to make them feel part of the company through dedicated experiences. In particular, as pointed out by Ross et al (2016), companies identify/create new communication channels with customers (aiming, in most cases, to omni-channel experiences) and to increase the interactions between the company and the customers themselves. An important aspect of this strategy is precisely the creation of communities through which customers are particularly involved in business activities.

With regard to strategies aiming at customer engagement, Capgemini report (2011) offers a more detailed classification of the activities that companies can implement to involve their customers (real and/or potential). In particular, businesses should aim at:

1. Customer understanding. Companies carry out detailed analyses (especially with reference to big data and new technologies available) about latent needs of customers. This, according to the Capgemini report (2011), is the first useful - and necessary - step to involve customers. Only if companies know what customers expect, then it is possible to have them tied to the company;
2. Top-line growth. The second step consists in the targeted offer of products / services to customers (of which information was collected through the activity mentioned above). Companies, therefore, must be able to anticipate customer expectations to best meet them. E-commerce (suggesting products suitable for each customer) and concept stores (present innovations to the most interested customers) are examples of activities that allow immediate business growth and long-term customer involvement;
3. Customer touch points. The contact points, i.e. the different ways in which the company and customers can interact, must be multiple (on-site and on-line) and, above all, must always be available for customers. Digital tools are leading companies towards omni-channel offer models through which customers can get in touch with the company at any time.

Obviously these three steps, customer understanding, top-line growth and the definition of customer contact points must be understood as synergistic activities that create a very close relationship between the company and customers (Table 1).

Table 1. The three steps of digital strategies oriented towards customer engagement

The goal of customer engagement can be achieved through…
Customer understanding
Top-line growth
Customer touch points

Source: personal elaboration.

In particular, starting from the collection of information, going through the provision of methods for presenting interesting products / services for customers and arriving at the definition of an omni-channel offer, companies can pursue the goal of long-term customer engagement.

The latter goal that companies can pursue through the definition and implementation of a digital strategy focuses on digitized solutions (Ross et al, 2016; Sebastian et al, 2017). In this case, companies aim to implement digital solutions that facilitate business activity. The strategy adopted aims to add value to the activities carried out. Technologies and infrastructures, in fact, allow digitizing whole processes or activities, or even only part of them, in order to improve their effectiveness and efficiency. The implementation of strategies oriented towards digitized solutions, obviously, is the result of a careful analysis that Chief Digital Officers - CDOs must carry out in advance. In fact, these must carefully evaluate whether and how it is appropriate to intervene.

Also with regard to strategies oriented towards digitized solutions, Capgemini report (2011) recommends some steps through which companies can achieve the predetermined goal. These three steps are:

1. Process digitization. The first step consists in identifying activities/phases of internal processes that can be digitized. It is necessary to evaluate carefully whether and which parts of the processes can be digitized. The effort, made in particular by the CDOs, is useful for improving processes and activities, reducing costs and times and maximizing results;
2. Worker enablement. The second step identified in the Capgemini report (2011) concerns employees. It is these, in fact, that manage and follow the activities and it is therefore of fundamental importance that the CDOs are able to modify the work of the employees, enabling them to work digitally (for example working remotely or eliminating real, concrete activities to make them digital);
3. Performance management. The last step concerns the internal decision-making model that, of course, is based on the collection and processing of information. In order to evaluate the possible alternatives and choose the one that, at least in the initial phase, is the best, it is necessary to collect information about all the company's activities. If the internal operating processes and the employees have been oriented towards the digitized solutions, then even for the top managers it will be possible to carry out the decision-making process more easily

Even these three steps, the digitalization of processes, the virtual enabling of employees and performance management must be understood as synergistic activities that can create greater value for the company (Table 2).

Table 2. The three steps of digital strategies oriented towards digitized solutions

The goal of digitized solutions can be achieved through…
Process digitization
Worker enablement
Performance management

Source: personal elaboration.

In particular, evaluating which processes and/or activities can be digitized, favoring the involvement of internal human resources in the digitization processes and developing the possibility of top management to use these digital solutions in order to make more appropriate decisions, companies can be sure that they have properly implemented digitized solutions internally.

The fact that the goals pursued are so different from each other, however, must be interpreted with caution. With reference to the short term, it is clear that companies must decide whether to give priority to customer engagement or to digitized solutions. In reference to the long term, however, this choice does not seem to have reason to exist. As pointed out by some scholars (Ross et al, 2016; Sebastian et al, 2017), in fact, the pursuit of one goal does not necessarily imply the exclusion of the other in reference to the long term. Indeed, even with reference to the short/medium term, it is reasonable to think that even if one goal seems to prevail over the other, the latter is never set aside completely. Indeed, in some passages (Ross et al, 2016), it seems that between the two objectives there can be an almost instrumental relationship. The pursuit of a goal (whether customer engagement or digitized solutions) can lead to the achievement of the other.

THE RELEVANCE OF DIGITAL STRATEGIZING

In order to understand how companies can try to pursue the previously identified objectives, it is appropriate to focus attention on digital strategizing, i.e. on the process by which companies define all aspects of their digital strategies before implementing them (Mithas & Lucas, 2010; Capgemini, 2011; Kane et al, 2015; Gobble, 2018; Westerman, 2018; Chanias et al, 2019).

With reference to digital strategizing, a clarification is needed. Many scholars, among the ones mentioned above, define the main aspects of this process without offering a reference scheme that can clarify the steps that make it up. This, of course, has the effect of not facilitating the understanding of a process that takes place according to a certain *iter*.

The contribution of Chanias and Hess (2016), instead, clearly expresses this sequence. The scholars, by recalling well-known theories in the managerial field (Mintzberg, 1978; Mintzberg & Waters, 1985), outline a precise sequence that marks the formulation - and hopefully the implementation - of digital strategies by companies. According to the scholars (*ibidem*), the starting point for the formulation of a digital strategy is the triggering event. This expression refers to any stimulus (a fortuitous or planned event) from which the need for change arises and, therefore, the need to plan a strategy arises too. In this case there is a reference to digital strategies.

The origin of these events is usually classified as internal or external to the company (Wheelen & Hunger, 2004). Internal triggering events[1] are related to endogenous factors or, in a broader sense, to

the activity carried out by the company and are events over which the company can exercise a certain level of control. External triggering events[2], on the other hand, are those exogenous factors, not directly related to the activity carried out, that the company cannot control in any way. Obviously, it is immediately clear how the difference between internal or external triggering events has certain relevance in reference to digital strategizing. Responding to an endogenous change - more or less controllable - is certainly different from responding to an exogenous change, which cannot be controlled in any way.

Despite the indisputable relevance of the previous observation, what matters most in reference to the digital strategizing is the response given by the companies (Chanias & Hess, 2016). Triggering events, in fact, involve the start of strategy planning, called strategy initiation. Within the company, therefore, mangers/entrepreneurs become aware of the need to formulate a digital strategy that can cope with the triggering event that has occurred. At this point, the reference scheme proposed by Chanias and Hess (2016) proceeds by focusing on deliberate and emerging strategies that manifest themselves within the company. While the former are defined by top management or by the entrepreneur (usually called top-down), the latter (usually called bottom-up) include strategic content generated by multiple groups of people within the company and, if referred to the digital economy, these contents are linked to the use of digital technologies and infrastructures. With particular interest, scholars highlight the way in which the deliberate and emerging strategies come to combine in view of the implementation of the strategy (realized strategy).

There are two main critical issues emerging from the reference scheme above. The first concerns the relationship between emerging and deliberate strategies. Given the role of top managers or entrepreneurs, who are interested in affirming their vision, emerging strategies are not always properly transposed and/or evaluated. Indeed, it often happens that these are not included in the digital strategies that are defined and therefore implemented.

The second critical issue concerns the internal origin of emerging strategies. Even if these strategies called "emergent candidates" are proposed by "organizational sub-communities" and are "technology-mediated practices" (Chanias & Hess, 2016, p. 4) their internal nature is evident. The contribution, therefore, despite being of great importance and of great utility, does not seem to go in the direction of a digital strategy. Digital strategizing, in fact, manages to leverage the strengths of a digital company, but does not seem to be able to seize the opportunities that derive from the outside.

Because of the second criticality just cited above, it is appropriate to focus attention on the way companies analyze internal and external factors before proceeding with their process of digital strategizing.

S.W.O.T. ANALYSIS

Before defining and implementing their strategies, companies must analyze the external (reference context) and internal factors that, inevitably, will influence the choices of managers. To this end, it is immediate the reference to the S.W.O.T. analysis that - as the acronym points out (Pickton & Wright, 1998) - focuses attention on strengths and on weaknesses within the company, and on opportunities and threats external to the company (which derive from the reference context). Since its origins (Dosher et al, 1960), this model has taken on a significant role in reference to the strategic planning activity because of its ability to combine and analyze jointly internal and external variables (Piercy and Giles, 1989). The end of the S.W.O.T. analysis, in fact, is to highlight the strengths and weaknesses of the company considered in order to exploit the former and monitor - and intervening, if necessary - on the latter. At

the same time, the model aims to highlight the opportunities and threats of the external environment in order to exploit the former and protect itself - in advance - from the latter. A winning strategy is one that sees the combination of strengths/opportunities. This occurs when the company has internal resources useful for exploiting external opportunities. Obviously, the company must always try to reduce the weaknesses and transform threats into new opportunities.

Given the undisputed importance that the model has assumed in reference to the definition and implementation of business strategies (Panagiotou, 2003; Humphrey, 2005; Helms & Nixon, 2010; Gürel & Tat, 2017), it is logical to apply this model also with reference to digital strategizing (Lee & Leem, 2018; Rozmi et al, 2018). With reference to the paradigm of doing business in the digital economy, in fact, it is interesting to reconstruct and analyze which external and internal factors can influence the strategic choices of companies and catalog them appropriately (Table 3).

Table 3. S.W.O.T. analysis

Strengths	**Weaknesses**
Positive internal aspects to leverage	Internal negative aspects to improve
Opportunities	**Threats**
Positive external aspects to exploit	External negative aspects to monitor

Source: personal elaboration.

Endogenous Factors: Strengths and Weaknesses of Digital Enterprises

The origin of the relevance of endogenous factors, in fact, can be placed temporally in the Nineties[3] thanks to the affirmation of two theoretical systems that strongly characterized the management studies: the resource-based view[4] (RBV) and the knowledge-based view[5] (KBV). While the first theoretical system emphasizes the importance of all the resources[6] available to the company, in order to achieve a lasting competitive advantage, the second attributes a leading role to intangible resources, especially knowledge (KBV). According to the proponents of KBV, in fact, even if resources are rare, valuable, imperfectly imitable and difficult to transfer[7], they are static resources that, in the long run, they are destined to lose their relevance. In order to obtain a competitive advantage over competitors, and to make it last over time, companies should therefore direct their interest towards intangible resources.

These ones, by definition, are dynamic (that is, they are more easily adaptable to unstable economic contexts, indecipherable and characterized by constant changes) and therefore are more suitable for achieving a lasting competitive advantage.

Since the 1990s, and until today, KBV has assumed an increasingly important role in management studies and this has led to important changes especially in the management of resources by companies. In fact, these, without ever sacrificing the management of material resources (which are still necessary for the production of goods and services), have had to pay increasing attention to the creation and exploitation of knowledge.

It is appropriate to say at the outset, and perhaps in a rather simplistic way, that creation and exploitation of knowledge are not two easy objectives to pursue. The processes through which companies aim to create new knowledge (Nonaka, 1994; Nonaka & Takeuchi, 1995; Nonaka et al, 2000) are not

always successful due to the reference economic context which - as already mentioned in reference the affirmation of the new paradigm of doing business in the digital age - it appears to be increasingly unstable, indecipherable and characterized by constant changes. Likewise, the exploitation of knowledge is also not a simple goal to achieve. In fact, companies must be able to protect the results achieved and to decide the most suitable strategies to maximize the economic returns obtainable from the economic exploitation of those results.

Therefore it happens that the new paradigm of doing business in the digital age, in the wake of the changes that have already occurred since the 1990s based on the affirmation of the KBV, requires particular attention to be paid to the human resources that work in businesses. These are, in fact, the most important strength on which companies must focus their attention to start and manage a digital business transformation in the best possible way.

Organizational Culture

With reference to human resources, and the role they assume - or, perhaps it would be more correct to say, they can assume - it is appropriate to focus attention on organizational culture when it comes to digital business transformation (Leidner & Kayworth, 2006; Shih & Huang, 2010; Müller & Nielsen, 2013; Lee & Berente 2012; Yoo et al, 2012; Parida et al, 2019; Ruthihinda, 2019). It is precisely the organizational culture, defined by entrepreneurs or top managers and shared with human resources, that represents the most important premise for the success, or failure, of a digital business transformation.

In reference to the digital business transformation of enterprises, scholars increasingly refer to the Competing Valuee Framework - CVF (Quinn & Rohrbaugh, 1983; Cameron & Quinn, 2006) that leverages two parameters to classify the organizational culture of companies. These parameters are stability/flexibility and internal/external focus. Based on the stability/flexibility parameters, the level of control exercised by top managers on the human resources working in the company (stability) or the discretion that is granted to them (flexibility) is analyzed. Based on the internal/external focus, however, it is assessed whether the human resources present in the company have reached a good level of integration (internal focus) or if they are oriented towards the outside, emphasizing the differentiation of their activities. By combining the two factors it is possible to obtain four archetypes of organizational culture (Table 4).

Table 4. Archetypes of organizational culture

	Internal Focus	**External Focus**
Flexibility	Clan 1	Adhocracy 2
Stability	3 Hierarchy	4 Market

Source: personal elaboration.

In the first quadrant there is the archetype of the clan that is characterized by flexibility and internal focus. As underlined by the scholars who proposed the framework (Quinn & Rohrbaugh, 1983; Cameron & Quinn, 2006) the clan-inspired organizational culture is based on cohesion, participation and sharing (focus indoor). There is considerable organizational flexibility, but everyone's attention is mainly

focused within the company. Always based on flexibility, but oriented towards the outside, it is instead the archetype of adhocracy (second quadrant). In this case, organizational flexibility is instrumental in adapting to external changes. In the third quadrant, however, there is the archetype of the hierarchy. In this case, the organizational culture is oriented towards stability (with rules and roles to be respected) and looks mainly within the company. In the last quadrant, the fourth, there is the archetype of the market. Also in this case, the organizational culture is oriented towards stability (with rules and roles to be respected), but an external focus prevails (attention is directed towards all events that can occur outside the company). Based on the parameters used (Quinn & Rohrbaugh, 1983; Cameron & Quinn, 2006), the proposed classification allows identifying what is - or should be - the organizational culture that businesses should develop to start and manage a digital business transformation. Surely companies should aim to develop and spread an organizational culture with an external focus (thus reducing the choice between two alternatives, adhocracy or the market) and, obviously, they should favor flexibility (thus making the final choice fall on adhocracy).

Table 5. The roles assumed by top managers in reference to the archetypes of organizational culture

	Internal Focus	**External Focus**
Flexibility	Top managers take on the role of mentor or facilitator if the organizational culture is inspired to clan 1	Top managers assume the role of entrepreneur or innovator if the organizational culture is inspired to adhocracy 2
Stability	3 Top managers take on the role of coordinator if the organizational culture is inspired to hierarchy	4 Top managers take on the role of decision maker if the organizational culture is inspired to market

Source: personal elaboration.

An organizational culture characterized by flexibility and an external focus therefore represents the premise for starting a digital business transformation.

Leadership

Even if the result achieved in the previous paragraph - that is, the relevance of the archetype of adhocracy, based on flexibility and external focus - could be a little obvious from the beginning, an important aspect that Rutihinda (2019) highlights is not as obvious. The creation and diffusion of corporate culture (whatever the archetype to which it refers) depend on leadership (McKee & Massimilian, 2006; Uhl-Bien et al, 2007; Kane et al, 2019; Larson & DeChurch, 2020). Depending on the role assumed by the top managers and their behavior, the organizational culture is directed towards one archetype rather than another.

In fact, in Rutihinda's contribution (2019), it is possible to read that if the top managers assume a role of mentor, facilitator or - even - of a relative then organizational culture is directed towards the clan (archetype characterized by flexibility and internal focus). If top managers take on the role of entrepreneur or innovator (taking on the risk), then the organizational culture moves towards the archetype of adhoc-

racy (characterized by flexibility and external focus). Furthermore, if the top managers take on the role of coordinator, supervisor, then the organizational culture tends towards the archetype of the hierarchy (characterized by stability and internal focus). Finally, if the top managers take on a decision-making role, oriented towards achieving the objectives, then the archetype of the organizational culture to which reference is made is that of the market. The different roles covered by the top managers in reference to the different types of corporate culture are shown in Table 5.

Top managers who are already involved in companies and who, for established practices, have already taken on a certain role - obviously linked to the organizational culture already in place in the company - cannot change their role so easily. In order for a subject to act as a leader in view of a digital business transformation and to direct organizational culture towards adhocracy it is necessary that this subject has different individual characteristics such as social intelligence, passion, empathy, an open mind, creativity, critical thinking, the ability to bring forward a virtual teamwork, co-creation, the ability to collaborate, communication, sharing, collaborative learning, knowing how to delegate power, the ability to empower others, the ability to anticipate the future, to have a clear vision and to establish ex ante objectives to be achieved. Some scholars define these subjects as *digileaders* (April & Dalwai, 2019; Promsri, 2019).

Over time, therefore, some scholars have formalized the figure of digileaders by assigning them - more appropriately - the role of Chief Digital Officer - CDO (Dumeresque, 2014; El Sawy et al, 2016; Singh & Hess, 2017; Tumbas et al, 2018; Berman et al, 2020; Kunisch et al, 2020). This subject, like other subjects who operate at the top management level and who have specific skills, is responsible for planning and guiding the digital business transformation. In particular, according to Larjovuori et al (2018), CDOs are expected to

- Define the strategic vision of the digital business transformation and plan the necessary actions to put it into practice. In particular, CDOs must act towards two objectives. From a high point of view, they must have a clear idea of what the future of the company could be; on the other hand, they must be actively involved in achieving these objectives;
- Guide the change of organizational culture (directing it towards adhocracy). CDOs must work on the mindset, on the organizational culture already in place, on learning to fail in order to guide the company towards change;
- Allow/facilitate change. With reference to this objective it is fundamental that CDOs act as coach, encouraging human resources to question what is being done and how it is being done. At the same time, CDOs must be able to promote an active, proactive participation of human resources;
- Guide networks. In particular, the attention of CDOs must be directed towards customers (who are always at the center of a digital business transformation) and towards collaborations and partnerships from which new opportunities can arise.

Obviously, the only leadership oriented towards a digital business transformation does not guarantee any success. In fact, it is increasingly emphasized that only if human resources share leadership, then it is possible to change the organizational culture. In this case, it is possible to identify one of the strengths to leverage on for a successful *digital business transformation*.

Exogenous Factors: Opportunities and Threats of Digital Economy

The emergence of digital economy has completely changed the way of doing business. ICTs and ICIs have caused a radical change in the competitive scenario in which companies operate, so it is necessary to start from the new external reference context.

The idea that many scholars share (Ross et al, 2016; Sebastian et al, 2017) is that businesses need to consider the new dominant technological standard (based on ICT and ICI) as the opportunity to be exploited. Only if companies focus on this opportunity, that is, on technological changes related to the digital age, can they take advantage of the seven forces to their advantage.

Although there seems to be a convergence of favorable opinions that technological changes can be an opportunity for digital businesses, there is no general agreement on the technologies that must be monitored with particular interest by digital businesses. According to the European Commission (2015, 2017), for example, the technologies on which digital companies should focus their interest are seven. All these technologies, due to the impact they can generate, are able to determine the success of digital businesses (Vidas-Bubanja and Bubanja, 2017). Specifically, they are: mobile services; social media; the cloud; the analysis of big data; the Internet of Things - IoT; IT security solutions; robotic and automated machines. According to the Boston Consulting Group (2015), however, the technological changes that can constitute an opportunity for digital businesses (in the report these changes are officially defined as pillars) refer to nine topics. These are: big data and analytics; autonomous robots; simulation; the horizontal and vertical integration system; the Industrial Internet of Things - IIoT; cyber security; the cloud; additive manufacturing; augmented reality.

Despite the relevance of the classifications proposed by both the European Commission (2015, 2017) and the experts of the Boston Consulting Group (2015), some scholars (Ross et al, 2016; Sebastian et al, 2017) have proposed different classifications considering only changes related to SMACIT technologies (the acronym stands for social, mobile, analytics, cloud and internet of things). In particular, according to Ross et al (2016), only if companies are able to capture the continuous changes related to SMACIT technologies, then are they able to define new value propositions for the market.

According to other scholars, it is not possible to overlook the changes related to technological (cloud) platforms or the relevance assumed by the blockchain (Vial, 2019).

The objective of this paragraph is not to evaluate the proposed classifications in order to determine which can be more or less correct. On the contrary, the objective of the paragraph is to identify a series of exogenous factors that may favor the digital transformation process of businesses. In this sense, a very interesting contribution is the one proposed by Denecken (2014) who, in analyzing the digital business transformation, considers available technologies (cloud, mobile technologies and big data) and also networks/ecosystems. In this way, the scholar aims to emphasize the idea that digital business transformation is not only a technological process (Tabrizi et al, 2019), but also something broader that must take place according to a holistic model. For this reason, attention is focused on the four key factors that can influence the digital strategizing process.

Four Key Factors

The first key factor that is mentioned (Denecken, 2014) is the cloud that is defined as a useful platform to provide a series of information upon request (Bhardwaj et al, 2010; Truong, 2010). Due to the undisputed utility of the cloud (Arvanitis et al, 2017; Hachicha & Mezghani, 2018; Lee, 2019), this is

precisely indicated as the key factor capable of leading to rapid development of the company and its digital business transformation. The usefulness of the cloud in digital business transformation lies in the fact that this platform (scalable, flexible and accessible) puts customers at the center of the company's interests. By exploiting the potential of cloud platforms, in fact, companies can reduce the gap between the company (and the people who work inside) and consumers. This allows companies to operate on the market with a better time-to-market (market demands can be met in shorter times) and in a more suitable way to satisfy the real needs of the market.

According to Denecken (2014), mobile technologies are the second key factor to consider. The reason is that mobile technologies are closely linked to the cloud: they represent a "necessary extension" (ibidem, p. 11). It is only by leveraging mobile technologies that the cloud acquires ever greater relevance: if you can connect at any time and from anywhere (through mobile technologies), then it makes sense to implement a platform to which everyone can connect to upload / download data (Bhimani, 2020; Yadav and Pavlou, 2020). This connection between mobile and cloud technologies pushes Denecken (2014) to refer also to the IoT that, therefore, represents nothing more than the use of connected mobile technologies.

Data are the third key factor that Denecken (2014) analyzes in his contribution. The creation of a cloud platform and the connection of mobile technologies make sense only if they are instrumental to the exchange of information and data. Data, in fact, allow companies to create new knowledge and, therefore, to operate better on the market, using less time-to-market and managing to better meet the needs of consumers / end users. As the scholar points out, in fact, when talking about data there is often a reference only to the quantity of data - the expression big data is very well known (McAfee et al, 2012; Chen et al, 2013; Li et al, 2015; Choi et al, 2018; Akter & Wamba, 2019). However, it should be noted that the data available to companies must be numerous, but they must be correct - Denecken (2014, p. 11) expressly speaks of right data, that is, correct and precise data that can be useful to companies in the activities of digital strategizing (Kwon et al, 2014; Ashrafi et al, 2019; Mikalef et al, 2019). In this regard, it should be noted that companies often collect large amounts of data that, however, may prove to be R.O.T. (redundant, obsolete or trivial) or DARK (unidentified and not usable).

The last key factor considered by Denecken (2014) is network (Kodama, 2000; Mathar and Gaur, 2020). In line with the most recent management studies (Acs et al., 2017; Sussan and Acs, 2017; Audretsch et al., 2019; Kopalle et al., 2020), the concept can be expanded referring to ecosystems (Luz Martín-Peña et al, 2018; Kohtamäki et al 2019). Although there is no single definition, it seems possible to argue that a business netwoek/ecosystem is a dynamic structure in which multiple stakeholders, different in nature - such as suppliers, distributors, customers, universities, research centers, public and private institutions and, of course, others businesses - interact in a certain environment and at a specific time. As it happens in natural ecosystems, also in business ecosystems the subjects involved interact to guarantee survival.

Due to the dynamics that take place internally, networks/ecosystems acquire an even greater relevance with reference to digital strategizing. In fact, from the interactions with many different subjects, companies can always draw new awareness. At the same time, they can direct the new knowledge generated towards these networks.

Table 6. The roles assumed by top managers in reference to the archetypes of organizational culture

Cloud	Mobile Technologies	Big Data	Network/Ecosystems
It is the platform from which to draw data and information useful for creating new knowledge and with which the new knowledge created is exchanged	They are instrumental to the use of the platforms. According to some scholars, they are an extension of the platforms. They are essential for loading data and querying platforms	They are the raw material, the content of the exchanges that take place on platforms and via mobile technologies. The easier the use of the platform and access through technologies, the greater the data available	They are the subjects from which the data depart and arrive, who use the platforms and exchange info and data via mobile technologies. They feed the process and push the digital transformation

Source: personal elaboration.

The four key factors analyzed by Denecken (2014) - the cloud, mobile technologies, big data and networks / ecosystems - are the aspects on which companies must work to transform the competitive forces present on the market (Hirt & Willmott, 2014) in new opportunities and not in possible threats.

In order for these factors to really be the basis of new opportunities, however, the company must come into contact with the outside world. The key factors, in fact, must not be read only from an external perspective, but - on the contrary - they must be a point of contact, of connection between the inside and outside of the company.

SOLUTIONS AND RECOMMENDATIONS

After reviewing and analyzing the exogenous and endogenous factors, it is possible to present the results of the S.W.O.T. analysis applied to businesses operating in the digital age (Table 7). The analysis does not refer to a particular company, in a specific sector or in a specific country. It is generic in order to reconstruct strengths and weaknesses, opportunities and threats of companies operating in digital economy.

Table 7. The results of the S.W.O.T. analysis applied to businesses operating in the digital age

Strengths	Weaknesses
- Role of CDOs (leadership) - Ability to change organizational culture	- Scarce authority of CDOs - Resistance to change
Opportunities	**Threats**
- Changes related to the cloud, mobile technologies, big data, networks / ecosystems	- Changes related to cloud, mobile technologies, big data, networks / ecosystems exploited by other companies

Source: personal elaboration.

The S.W.O.T. analysis applied to companies operating in the digital economy is essential to start planning digital strategies. As it happens with reference to the planning of business strategies generally understood, and with reference to the planning of digital strategies, companies must try to defend themselves from external threats (critical issues or negative aspects external to the company) and to compensate for the weaknesses that have emerged (negative aspects within the company). At the same

time, companies must leverage their strengths (positive aspects within the company) to seize market opportunities (positive aspects outside the company).

As emerged from the analysis conducted in the previous paragraphs, the combination of strengths / opportunities in reference to doing business in the digital economy concerns the role of CDOs, which must succeed - through leadership - in the aim of spreading an organizational culture of change-oriented enterprise (creating it from scratch if it does not exist or strengthening it if it is already widespread in the enterprise) and involving human resources (pushing all human resources to overcome their inertia or resistance to changes), and the possibility of exploiting changes technology related to the digital age.

These two factors, although with a different nomenclature, seem to be recalled in a report published by Capgemini (2011) that classifies companies interested in digital transformation based on their digital maturity. In particular, digital maturity is given by two variables: digital intensity and the intensity of transformation management. The first variable refers to the digital capabilities that the company can exploit, while the second variable refers to the attention paid to predicting and managing the company's transition into the digital future. From a careful reading of the description of the variables contained in the Capgemini report (2011) it seems that the former can be considered as a market opportunity (diffusion of technologies that the company can exploit to its advantage) while the latter seems can be considered as one of the main strengths (ability to predict and guide the transition to digital). By combining the two variables, which may have high or low levels, four types of firms are obtained (Table 8).

Table 8. The roles assumed by top managers in reference to the archetypes of organizational culture

	High Transformation Management Intensity	**Low Transformation Management Intensity**
High digital intensity	Digirati	Fashionistas
Low digital intensity	Conservatives	Beginners

Source: Adaptation from Capgemini (2011, p. 60).

From Table 8 it results that some companies (digirati) are more ready to start and manage digital transformations. These companies (which report high digital intensity and high intensity of transformation management) possess the strengths seen before and are more inclined to exploit the opportunities that derive from the context (ability to exploit technologies). In an opposite situation (with a low digital intensity and a low intensity of the transformation management) there are the beginners companies that - based on the parameters considered - do not seem to be ready even to start a digital transformation. Companies called conservatives or fashionistas are placed in an intermediate situation. Conservative companies are characterized by a low digital intensity and a high intensity of transformation management. In this case, a long-term digital vision is present in the company, but the company has not yet made significant progress with regard to the possible exploitation of technologies. Finally, there are the companies and fashionistas, characterized by a high digital intensity and a low intensity of the management of the transformation, who know what technologies are to be exploited on the market, but do not yet have a clear vision of the digital transformation to be carried out. According to the assessments contained in the Capgemini report (2011), therefore, the companies that can apply to start a successful digital business transformation only those that report high digital intensity and high intensity of transformation management (digirati).

FUTURE RESEARCH DIRECTIONS

In line with the research question at the basis of this chapter (aiming to investigate and recognize the value of the discipline of management in digital business transformations), future studies are evoked in order to re-balance the relationship between information technology and engineering disciplines, on the one hand, and management discipline, on the other one, when talking about digital business transformations. Management scholars are invited to consider practical examples of digital business transformation put into practice by companies (LEGO, Apple, McDonald's and Rowenta are just few of them) and to read and analyze them through the lenses of management discipline. This could be very useful to disclose the principles of management studies (beyond S.W.O.T. analysis and strategic planning) that play a relevant role when companies define and implement digital strategies and to strengthen the idea that digital business transformations are business-driven and technology-enabled processes.

CONCLUSION

Based on the reading of the variables proposed in the report according to the S.W.O.T. analysis conducted, it seems possible to argue that management and strategies for digital enterprise transformation is for companies that:

- Have strengths (linked to a CDO or a leader with a clear vision of digital transformation and capable of involving human resources);
- Can take advantage of opportunities (technological changes related to the digital age).

These are the companies that - first of all the others - should start digital strategizing activities in order to plan and start a concrete digital business transformation (Weill & Woerner, 2018).

The use of the S.W.O.T. analysis, in reference to the start of the digital strategizing activities, clearly underlines the importance of management studies in reference to digital business transformations. The model used, the approach followed and the analysis carried out, in fact, are rooted in the management discipline. Technologies are therefore evaluated and, if necessary, implemented after appropriate economic evaluations. Despite the important role that technologies play in a digital business transformation process, it does not seem possible at all to question the role of management that remains fundamental in the planning and implementation of these activities.

The analysis phase and the evaluation of the pre-conditions (useful to determine if it is appropriate to proceed with a digital business transformation) confirm that management and strategies of digital enterprise transformation are business-driven strategies (Kane et al, 2015). Technologies, which are evaluated through economic models, approaches, and analyses, can favor or prevent the implementation of digital business transformations that, therefore, turns out to be technology-enabled.

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ENDNOTES

1 Among the possible internal triggering events, Wheelen and Hunger (2004) include: the appointment of a new CEO or a new president; a negative result in the performance (performance gap); a change in company ownership; a change of managers within the company; a reorganization or restructuring of the company; the offer of new products/services.

2 Again according to Wheelen and Hunger (2004), the possible external triggering events concern: changes in the economic scenario understood in its entirety; the role of governments; socio-political, technological, local/regional aspects; market factors (meeting between supply and demand); the religious environment and natural phenomena or calamities.

3 Even before the Nineties, management studies had been overwhelmed by some important changes. In particular, the "Structure-Conduct-Performance" (S-C-P) paradigm had been somewhat questioned thanks to the contributions of Caves (1964) and Bain (1968). According to these scholars, in fact, the idea that only the structure of the sector was able to influence the conduct of companies and lead to the achievement of a certain performance was no longer acceptable. Thus, the concept of feedback is introduced in the sense that even the conduct of companies (i.e. the strategies adopted by companies) can influence the structure of the sector, thus determining the achievement of a certain performance. It therefore happens that from the old theoretical structuralist system S-C-P we move to a new theoretical system "Conduct-Structure-Performance" (C-S-P) which takes the name of behaviorist.

4 Origins of the resource-based view (RBV) can be traced in the contribution of Penrose (1959) who, for the first time, invites us to dwell on the importance that internal resources, those owned by the company, can have for the purposes of competition on the market. The proposal, which distances itself from the theoretical paradigm to the dominant era, focused instead on the influence that the external environment has on the company, is so innovative that it does not immediately attract the attention and interest of the other economics scholars of company. It will take about thirty years for other scholars (Rumelt, 1982; Wernerfelt, 1984, 1995; Barney, 1986, 1991; Dierickx & Cool, 1989; Grant, 1991) to re-evaluate Penrose's theoretical proposal (1959) and consider it as a possible paradigm to study the performance of businesses.

[5] The knowledge-based view (KBV) of the firms was born and developed in the second half of the nineties thanks to the contributions of Conner and Prahalad (1996), Grant (1996) and Spender (1996) which, among the resources to which the RBV refers, they identify knowledge as the most important resource for companies in order to compete on the market.

[6] In the context of the RBV, in fact, Barney (1991) underlines that the achievement and maintenance of the competitive advantage depends on three categories of resources: physical resources (ranging from fixed assets to raw materials); human resources (experiences and skills of managers and employees); organizational skills (formal and informal relationships initiated both internally and externally). The ability to combine all these resources in an always-new way guarantees the company obtaining and maintaining its competitive advantage.

[7] Barney (1991) proposed the assumption that resources are rare, valuable, imperfectly imitable and difficult to transfer.

Chapter 10
Technopreneurship Development:
Digital Strategy for Youth Self-Employment in the Digital Economy

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ABSTRACT

South Africa's unemployment rate is among the highest in the world with the youth being the most affected by joblessness and accounting for 63.3% of the total number of unemployed persons. A comprehensive strategy for youth employment as part of a broader focus on expanding employment is therefore necessary. This chapter assessed the status of technopreneurship development and identified key variables that determine a successful technopreneurship. Theory U, entrepreneurship orientation, and triple helix models were reviewed to better understand the drivers of technopreneurship development. The study identified barriers to effective technopreneurship development including inadequate funding to support young technopreneurs, weak linkages between stakeholders, lack of awareness in technopreneurship opportunities, lack of infrastructure, lack of appropriate mentors and role models. The chapter further proposed a conceptual model for successful technopreneurship development.

INTRODUCTION

Unemployment is one of the major challenges faced by youth in African countries and globally. For the past few years, economic development and job creation has been the main concern for youth in Africa, particularly in South Africa and this paints a bleak picture for social development and the future of youth. As noted by Hoidn and Karkkainen (2014) the future economic growth and social progress in knowledge societies rely increasingly on young technopreneurs. Technopreneurs have a very specific function in the economy as they create employment, productivity growth and produce and commercialize high-quality innovations (Van Praag & Versloot, 2007). Digitalization may also be considered as one

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of the coupling mechanisms between different dimensions of the socioeconomic system (technological, social, economic, and ecological) (Satalkina & Steiner, 2020). However, it represents a source of new challenges to the resilience of socioeconomic systems; on the one hand, it comes with opportunities and also brings new risks and unforeseen consequences (Scholz, Czichos, Parycek & Lampoltshammer, 2020). Studies by Oakey (2003) and Kakati (2003) identified technopreneurship as the most imperative factor to be considered for enhancing competitiveness, economic development, social stability and job creation. A shift towards fostering technopreneurial spirit among youths could therefore be one of the most effective means to mitigate both unemployment and social challenges in disadvantaged communities. Venkataraman (2000) define technopreneurship as a process through which entrepreneurs are putting together organizational resources, technological systems and necessary strategies used by entrepreneurial firms to follow opportunities. Technopreneurship may provide youth in the digital world a flexible space within which to not only display their creativity but also to make an income.

Technopreneurs refer to the technological entrepreneurs or technology-based entrepreneurs who combine the factors of production and their entrepreneurial skills with technology to set up new business (Jusoh & Halim, 2013). Paramasivan and Selladurai (2017) refer to technopreneurs as those who are ready to incorporate the innovation and creativity in their business process with the help of technical background. Technopreneurs use technological innovations and translate such technology into successful products or services (Jusoh & Halim, 2013). Technopreneurship and small medium businesses development are therefore seen as conduits for sustained economic growth and to promote self-employment in developing countries. For some young people around the world, self-employment provides income, self-reliance and a dynamic path for growth and the development of human capital (Schoof & Semlali, 2008). The self-employed are very heterogeneous group of people working on their own account, from entrepreneurs and small business proprietors to freelancers and subcontractors (Institute for Employment Studies) (IES) (2020). The generic competences required for success in self-employment, as outlined by IES (2020) include:

- Values, beliefs and attitudes (e.g. action orientation, desire for independence, initiative, creativity etc.);
- Soft skills (interpersonal, communication and networking skills);
- Realistic awareness of the risks and benefits of self-employment;
- Functional business skills (financial, HR management, market research); and
- Relevant business knowledge (legislative, taxation, sources of finance etc.).

On the other hand, entrepreneurship can be described as the process of creating something new and valuable (Lukic, 2012). Sharma and Chrisman (1999) identified two clusters of thought on the meaning of entrepreneurship. One group focused on the characteristics of entrepreneurship (i.e. innovation, growth, uniqueness) while a second group focused on the outcomes of entrepreneurship (i.e. the creation of value). Adeoti (2019) further described entrepreneurship as the process of organizing factors of production to create new value that can result in profit. In the process, the entrepreneur takes risks and make different combinations of factors of production in order to ascertain the best option that yield the most beneficial returns on investment (Adeoti, 2019). Entrepreneurship thus involves recognizing and seizing opportunities, transforming those opportunities into marketable goods or services, assuming risk and realizing rewards. It may occur in a variety of settings, including new and old ventures, non-profit institutions and the public sector.

Although digital transformation offers many opportunities for the firms, including the self-employed however, only about 2% of youth are taking full advantage of the digital economy (European Commission, 2014). There is also a large gap in adoption rates of digital technologies among youth and as indicated by Organization for Economic Co-operation and Development (OECD) (2019) in international survey, it is estimated that youth accounted for only 15.6% of digital start-ups, in 2018. These gaps are due to many factors, including a lack of mentors and role models, ineffective networks, lack of funding or access to finance and lack of digital and entrepreneurship skills. One of the drawback identified in the literature review is the limited mention of technopreneurship concept and policy measures which could assist young people in becoming technopreneurs. Tailored policy actions are thus needed to address obstacles to technopreneurship development and to support young technopreneurs.

Although government undertaken various initiatives to promoting youth self-employment through technopreneurship development, however, the current available initiatives are not sufficient to service the much needed technopreneurs in the country. As a result, the young generations of South Africa are helpless with anger and blames the government that they are useless and having no idea about to solve this issue. In addition, clinical research in the emerging field of psychoneuro-endocrinology has found that young people globally, are experiencing feelings of hopelessness and helplessness (Weinberg, 2015). The Global Entrepreneurship Monitor (GEM) (2016) report noted that feelings of anxiety and hopelessness might be related to fear of failure linked to social stigmatisation, low self-motivation and unrealistic expectation of what it takes to be an entrepreneur in South Africa. This chapter thus aimed at investigating the status of technopreneurship development and its major determinants. The chapter looked into international and national initiatives and strategies used in developing and supporting technopreneurs in order to grow the number of new technopreneurs in developing countries such as South Africa.

STATEMENT OF THE PROBLEM

Technopreneurship has been identified as an effective strategy and important source of employment and economic growth in most countries, however, South Africa is lagging behind on this front. The motivation for investigating the status of technopreneurship development in South Africa is threefold. Firstly, South Africa has consistently ranked very poorly in the Global Entrepreneurship Monitor survey in terms of entrepreneurial activities (GEM, 2015) and it is clear that the country is not producing a sufficient entrepreneurial economy. Therefore, these needs to be addressed so as to create employment, expand markets, increase production and revitalize communities. Furthermore, very few initiatives are available on developing young technopreneurs and to improve the employability of youth exiting school. Although, the government has implemented various strategies and initiatives to encourage entrepreneurs and small businesses but there is still a need for more initiatives focusing on technopreneurship development to service the much needed young technopreneurs.

Many economists accept the idea that technopreneurs are innovators, however, technopreneurs specifically in African countries are not truly innovators in the traditional sense. For example, these technopreneurs rarely produce brand new products, rather they imitate the products and processes (creative imitation) that have been invented elsewhere in the world (typically in developed countries). Most young people are also not sure what they are good at or what they want to do with their lives (Van Der Westhuizen, 2017). Darso (2013) pointed out that young entrepreneurs should identify what they are good at and become more mindful of what is needed by the community, the nation and the world at large. It

is also difficult for youth to see how best to use the particular skills they already have or that they may potentially acquire (Van Der Wethuizen, 2017). Okpara (2007) describe entrepreneurship as innovative, creative, flexible, dynamic and prone to take risks, and argued that the organization that is not creative and innovative cannot survive in the market place. Fostering creativity and innovation skills among youth will influence youth to become technopreneurs and be able to create or discover their unique and original products and services. The objectives which guided this study were to:

- Assess the status of technopreneurship development in South Africa;
- Determine the major drivers of technopreneurship development;
- Establish the barriers hindering the effective development of technopreneurship among youth in South Africa;
- Determine the role of universities, industries and government in promoting technopreneurship development among youth; and
- Propose a conceptual model to promote technopreneurship development among youth.

RESEARCH METHODOLOGY

This chapter was based on a review of extant literature to assess the status of technopreneurship development and analysis of its major determinants. Secondary sources, including books, journals and research reports on initiatives published by governmental and international agencies available in official web sites as well as articles on previous studies reporting on technopreneurship development and their challenges were reviewed. This methodology was used to apply and increase knowledge in a particular area of research thereby showing proficiency in reviewing, synthesizing and critically analyzing the relevant research literature. Theory U, Entrepreneurship Orientation model and Triple Helix model were also reviewed to understand the drivers of technopreneurship development. The study further proposed a conceptual model based on literature review findings and theoretical frames.

CONCEPTUAL FRAMEWORK

The combination of theories and models were required to give grounded coherence to the study and to understand the factors that constitute a model for succesful technopreneurship development. Theory U, Entrepreneurial Orientation (EO) model and the Triple Helix (TH) model were used as theoretical frames to guide the study.

Theory U

Theory U provides a model to facilitate profound change on a systemic level, starting with the individual entrepreneurs and how they interact with themselves (Scharmer & Kaufer, 2013). Theory U can be seen as a theoretical framework, a research methodology or in its simplest form as a social technology tool (Van der Westhuizen, 2016). This theory makes it possible to work productively with a person's interests, passions and unique talents (Darso, 2013). It consist of five elements or processes and these include: co-initiating, co-sensing, co-inspiring, co-creating and co-evolving (Scharmer & Kaufer, 2013).

Co-sensing entails seeing reality from the edges of the system and establishing the horizontal connection. The sensing stage enables the individual to break through old patterns by stepping into different but relevant experiences. This stage helps in building relationships with key stakeholders to obtain a system perspective of the environment and of relevant ideas. Theory U can help entrepreneurs to move from a reactive response field to a generative response field, especially in terms of "co inspiring." In this process, conscious introspection enables entrepreneurs to connect with their source of inspiration and will (Scharmer & Kaufer, 2013), and the connection may in turn lead to innovation or conceptualisation of "the new", which can be new ideas and opportunities, new insights or new motivation. Co-creating is prototyping to learn and explore future by doing and bringing the new into reality while co-evolving is embodying and institutionalizing the new and evolving the larger eco-system.

Entrepreneurial Orientation Model

Entrepreneurial Orientation (EO) model involves the processes, practices and decision-making activities that lead to entrepreneurship (Franker & Lüthje, 2004). Entrepreneurial orientation was initially defined by Miller (1983) as an entrepreneurial firm that engages in product-market innovation, undertakes somewhat risky ventures, and that comes up with 'proactive' innovations, and beating competitors to the punch. Okhomina (2010) defines EO as an important element of Entrepreneurial Intention (EI) that differentiates entrepreneurs from non-entrepreneurs according to their risk-taking, innovativeness and proactiveness capabilities. Lumpkin and Dess (1996) further refined EO and suggested a five-dimension model which includes autonomy, innovativeness, risk-taking, pro-activeness and competitive aggressiveness Although, there is a connection between a firm's propensity to be innovative, proactive and risk taking and the deployment of knowledge-based resources leading to higher firm performance, there is also a connection on the individual level with regard to a human being exploiting his knowledge-based resources to make a successful decision to become an entrepreneur (Van Der Westhuizen, 2017).

The concept of EO can apply to individuals as well as organizations (Robinson & Stubberud, 2014), and understanding EO at the individual level (Individual Entrepreneurial Orientation) could be beneficial to future business owners, business breeders and potential investors (Bolton & Lane, 2012). Individual Entrepreneurial Orientation (IEO) is thus understood to be a comprehensive evaluation of individual tendency towards entrepreneurship (Basso et al., 2009). As stated by Boyd and Vozikis (1994) belief in oneself is necessary in the development of entrepreneurship, and individuals with a higher degree of self-confidence are more likely to become successful entrepreneurs. Technopreneurs should thus assess their competence and capability if they want to start their new business. The study by Koe (2016) has also taken the three conceptualized dimensions of EO, innovativeness, proactiveness and risk-taking as the items of the IEO construct.

Therefore, for socio-economic development to occur through acts of entrepreneurialism it is necessary to develop individuals' ability to take risks, proactivity and degree of innovativeness. Innovativeness refers to an eagerness to support creativity and new products, becoming technological leaders and establishing new processes (Lumpkin & Dess, 1996). It is the process whereby an entrepreneur creates a variety of new combinations of resources to start his or her business serving chosen markets. Pro-activeness refers to an opportunity seeking perspective that entails introducing new products or services in anticipation of future demand and shaping the market (Lumpkin & Dess, 2001). It involves the entrepreneurial actions to manage future opportunities in terms of technologies, products, markets and customer demands. Risk-taking involves the propensity to take bold actions such as venturing into unknown markets and al-

locating a large portion of resources into ventures that have uncertain outcomes (Kitigin, 2017). IEO can also be considered as entrepreneurial competencies that can be learned through proper entrepreneurship education. Entrepreneurship education is an important factor in fostering and developing entrepreneurial interests and behaviours among the younger generation because education is a source of attitude and overall intention to become successful entrepreneurs in the future (Kurczewska et al., 2018).

The study by Robinson and Stubberud (2014) found that Norwegian and American students who completed the entrepreneurial course agreed that they were more creative and innovative and demonstrated higher entrepreneurial intent than before. Yurtkoru et al. (2014) supported the view that entrepreneurship is an intentional process and confirmed that being a risk lover and willingness to take risk positively affected an individual's entrepreneurial intention. Ekpe and Mat (2012) also conducted the study on IEO as a multi-dimension construct and found that self-efficacy and education were having significant positive influence on Entrepreneurial Intention among female undergraduate students in Nigerian universities. Cultural, political, legal, macro-economic and micro-economic environmental factors can also influence the EO of the pre-nascent entrepreneur.

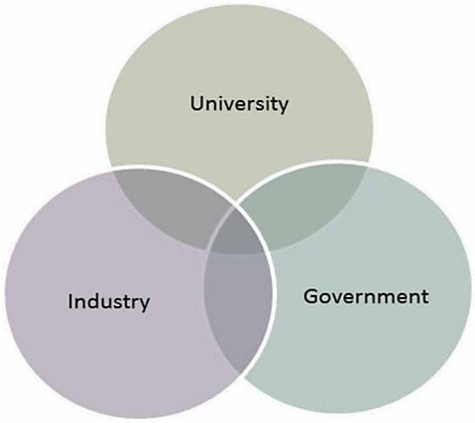
Triple Helix Model

Triple Helix (TH) model attempts to capture the transformation of roles and relationships among the emerging primary institutional triad of university-industry-government (Etzkowitz, 2008). TH model describes interactions among the major stakeholders (universities, industry and government) involved in knowledge creation and capitalization, and how to optimize commercialization of knowledge (Etzkowitz, 2008). According to Etzkowitz (2008) industry becomes the dynamic to the TH model, taking on the role of production while the government is attributed responsibility for overseeing the contractual relationships capable of guaranteeing interactions and stable relationships of exchange with universities allocated the role of producing new knowledge and technology. TH model thus argues that interactive innovation networks need to be created between academics, industries and government so that:

- Opportunities may be opened up for brain circulation and knowledge sharing between academics, business practitioners and government managers;
- Academic research is linked with business practice and informed by real market demands;
- Entrepreneurial culture is developed and new startups may be created from TH innovation; and
- New policy initiatives may emerge from the networks, giving the government a better understanding of where research is located, thus enabling them to design policies to support new research areas (Etzkowitz, 2008).

The involvement of university, industry and government in the process of technopreneurship development therefore results in a creation of a new overlay of trilateral networks and organizations from the interaction among the three helices. Each helix may relate to the other to develop an overlay of communication, networks and organizations among themselves. University, industry and government are thus conceptualized as intertwined spirals with different relations to each other in the classic innovation regimes, as depicted in Figure 1.

Figure 1. Triple Helix model
(Etzkowitz, 2008).



The first step in a triple helix is usually collaboration, taking place through stakeholders' traditional roles, among the institutional spheres most involved with innovation (Etzkowitz, 2008). For example, universities, industries and governments in a region may participate in discussions to enhance a local economy, develop a regional growth agreement or establish a technology council. As a result, government municipalities may be responsible in building permitting processes for new plant construction, universities may undertake to train more students in an area relevant to the local economy while industries may negotiate new supplier relationships with each other as an incipient cluster (Etzkowitz, 2008). At this initial level of the triple helix, the three strands typically begin to interact in order to improve the local economy, and the government plays the leading role, driving academia and industry (Etzkowitz, 2008).

ROLE OF TECHNOPRENEURSHIP IN THE DIGITAL ECONOMY

South Africa's estimated 50% youth unemployment rate, and many youngsters and graduates are unable to find employment. This is further compounded by a 16% decline in entrepreneurial skills among youth between 18 - 34 years old (GEM, 2015). Youth in South Africa are therefore beginning their adult lives in poverty, with limited skills, very few opportunities to access formal employment and no foreseeable way to make a decent living. These young entrepreneurs could therefore be more likely to benefit from digital technologies for business creation and growth, including the wider access to external markets offered by the internet (OECD, 2019). With today's economic globalization alongside the booming digital age, the country should therefore encourage unemployed youths and graduates to develop entrepreneurial spirit through technopreneurship. New technologies such as the internet have become a strategic point in the process of the industrial revolution 4.0 especially in entrepreneurship today, often referred to as the digital business revolution (Rojko, 2017).

Technopreneurship development is globally acknowledged as an alternative to generate employment and stimulate economic growth. It leads to increasing economic efficiency, bringing innovation to the market, creating new jobs and maintaining job levels (Koe et al., 2018). As observed by Pribanic (2018) technopreneurship has allowed every business from infrastructure and software to e-commerce and even

trade to become more successful and perform business duties more seamlessly and efficiently. Technopreneurship has also redefined e-commerce with the help of the internet and has improved the process by allowing companies to provision better means to sell and deliver their products, services, information and even payments over computer networks or other electronic means (Pribanic, 2018). This innovative approach has allowed companies to run their business process electronically through electronic networks. Examples of successful technopreneurs that engage in digital world include Bill Gates, co-founder of Microsoft Corporation, Steve Jobs, co-founder of Apple, Andrew Houston, co-founder of dropbox, Nathan Blecharczyk, co-founder of Airbnb, Mark Zuckerberg, co-founder of facebook, Kevin Systrom, co-founder of Instagram and Jack Dorsey, co-founder of Twitter, just to name a few.

Technopreneurship and Digital Marketing Strategies

Technopreneurship is basically the adoption of digital technologies and the creation of digital businesses by existing entrepreneurs. While technopreneurs are individuals who have expertise in mastering technology so they can see business opportunities in the field of technology (Irene, 2019). Technopreneurs have a reliance on digital media tools and Information Technologies in the pursuit of entrepreneurial prospects, and are offered significant opportunity through the use of digital networking capabilities (Giones & Brem, 2017). Digital business allows products to be sent around the world quickly and cheaply, and in the past, customers were forced to rely on their local merchants. The most famous examples of digital business are Airbnb, Uber, Alibaba, Amazon and Netflix. Some other recognizable digital ventures include monetized content creation on social media platforms like YouTube, Facebook, Twitter, Instagram, TikTok and blogs. Nowadays, the Internet makes a huge assortment of products and services available to everyone and the efficient technopreneurs can deliver physical ordered goods almost anywhere within twenty-four hours with minimal difficulty. This allows the technopreneurs the chance to address a worldwide demand that may not be sufficiently concentrated to support a local business. In the 21st century, businesses cannot afford to ignore digital marketing, because doing so would amount to opening a business, but not telling anyone (Ahmad & Al-Khateeb, 2019).Technopreneurship thus promotes digital or online marketing and also helps businesses to engage users online and help brands in connecting with customers. It makes it easy and more affordable to start and maintain a business because of the technological resources available online such as social media or digital marketing. Digital marketing is the component of marketing that utilizes internet and online based digital technologies such as desktop computers, mobile phones and other digital media and platforms to promote products and services (American Marketing Association, 2019).

As people increasingly use digital devices instead of physically visiting shops, digital marketing campaigns have become prevalent, employing combinations of Search Engine Optimization (SEO), Search Engine Marketing (SEM), content marketing, influencer marketing, e-commerce marketing, social media marketing, social media optimization, e-mail direct marketing, display advertising, just to name a few. Brands and businesses have incorporated digital marketing into their marketing due to the fact that more people make use of digital devices as opposed to actually visiting official residences physically. Digital marketing is not only seen as a powerhouse for brands and business but it is also tied to data which helps informs marketers about the interest of the audience and the intent of the consumer. Many businesses regardless of the kind of products or services they offering use digital technologies for marketing. Some of digital business opportunities in the digital marketing industry are:

Social Media Marketing

Social media is the collection of computer-mediated tools in the form of online communication channels dedicated to community-based interaction, input, feedback, content-sharing and collaboration (Funk, 2013). Social media marketing is the use of social media platforms and websites to promote a products or services (American Marketing Association, 2019). It can be understood as the sharing of information and content on internet platforms that foster a virtual community in real-time among multiple people around the world (Sharma & Verma, 2018). Most social media platforms have built-in data analytics tools, enabling companies to track the progress, success and engagement of ad campaigns. Companies address a range of stakeholders through social media marketing, including current and potential employees, journalists, bloggers, and the general public (Felix, Rauschnabel & Hinsch, 2016). A lot of start-ups are growing through social media advertising. There are different kinds of social media networks that satisfy several needs including LinkedIn (professional and job seeking site), second life, fortnite and minecraft (for gaming and entertainment) as well as TripAdvisor (information sharing sites) (Duffet & Wakeham, 2016). Social media sites such as Facebook and Twitter has also become advertising platforms for start-ups to leverage growth, and are easily reachable to anyone with internet access. These social networking sites are one of core service provisions for companies that want immediate sales without having to wait for their Search Engine Optimization to kick in.

YouTube is another popular avenue for advertising and the ads on this platform are presented with certain videos since the content is relevant and are usually in sync with the content of the video requested (Kincy, 2011). It enable publishers to earn money through its YouTube Partner Program. Companies can pay YouTube for a special "channel" which promotes the company's products or services. The ripple effect of social media marketing has also given rise to the prominence of content creators as invaluable factors in promoting a product or service. Content creators refer mainly to bloggers and vloggers in diverse industries who are using their social media pages on Facebook, Twitter, Instagram and YouTube propelled by their popularity to promote brands in exchange for money. Blogs are promotional techniques for keeping customers, and also for acquiring followers and subscribers who can then be directed to social network pages (Deis & Hensel, 2010). Companies that recognize the need for information and accessibility employ blogs to make their products popular, unique and ultimately to reach out to consumers who are privy to social media (Chiang & Hsieh, 2011). Consumers view coverage in the media or from bloggers as being more credible than print advertisements (Rinallo & Basuroy, 2009). Content creation and blogging have become a creative and innovative use of technology around the world. Some content creators have taken these opportunities and become technopreneurs, starting their own online businesses.

Influencer Marketing

Marketers have come to the understanding that consumers are more prone to believe in other individuals whom they trust (Sepp, Liljander, & Gummerus, 2011). Influencer marketing is a type of marketing whereby companies are using key leaders to drive their brand's message to the larger market. A social media post by an opinion leader can have a much greater impact than a post by a regular user because of their social status and potential to influence other people. Instagram influencer marketing is a well-known strategy. Marketers target influential people, referred to as influencers, on social media who are recognized as being opinion leaders and opinion-formers to send messages to their target audiences and amplify the impact of their message (Fill, Hughes, & De Francesco, 2013). An influencer marketers have

a strong following base because their opinion is valued or trusted and ensure that the client's products or services are marketed using appropriate influence to sway the decisions of the buyer. This could be through personal testimonial on the website, the use of a celebrity and bloggers.

FINDINGS AND DISCUSSION

The findings are presented under the following themes: the status of technopreneurship development in South Africa, determinants of successful technopreneurship development, barriers to effective technopreneurship development, the role of stakeholders (universities, industries and government) in promoting technopreneurship development. The study further proposed a conceptual model to promote technopreneurship development.

Technopreneurship Development in South Africa

Government and Higher Education Institutions in South Africa are continuously analyzing and developing strategies which can be used to stimulate economic growth and prosperity. Technopreneurship development has been regarded as one of these strategies and as a significant source of income to most nations as it provides job opportunities, wealth and societal well-being to the nations. Technopreneurship has thus become the best solution and an option in most countries, the world over. One of the first steps in developing technopreneurs is unleashing young people's creativity and innovation skills through formal and non-formal learning. Government and universities across the world also play an important role in providing young people with creativity and innovation skills through various initiatives, with a view that acquiring such skills and attitudes that can contribute to economic development and job creation. The aim of developing creativity and innovation skills is to help young people become future entrepreneurs and upgrading their skills in a changing environment in which 'a job for life' no longer exists (Arnkil, 2015).

South Africa as a developing nation has for long explored and formulated structures and strategies to promote technology-based small medium enterprises (SMEs) growth and to offer a promising future within the global marketplace. Greater emphasis has been placed on technology based industries such as information technology, biotechnology, automotive, and the electrical and electronics industries. The South African Institute for Entrepreneurship (SAIE) helps to address poverty and unemployment through entrepreneurially focused initiatives. The institute was born out of the Triple Trust Organization (TTO) in 1996 in recognition of the critical need for easily accessible business literacy training materials for both the small enterprise sector and for schools (TTO, 1996). With nineteen years of experience in developing innovative and experiential based training materials, the SAIE promotes a positive mindset in youth and adults across South Africa and assist in the creation of effective entrepreneurs and enterprises. The SAIE trains educators, trainers, co-operatives and community-based organizations to convey business skills, uncover entrepreneurship qualities and ensure sustainable economic development and wealth creation. Another initiative is the Entrepreneurship Development Programme (EDP), aimed at creating a conducive environment to young entrepreneurs to access relevant entrepreneurship skills, knowledge, values and attitudes for their businesses. The programme offers a package of entrepreneurship trainings that responds appropriately and adequately to the labour market and business needs of the young people including basic entrepreneurship skills, characteristics of an entrepreneur and basic business requirements.

The Youth Empowerment Project (YEP) was also developed in October 2011, with the aim of promoting entrepreneurship in selected townships of South Africa's Western Cape. YEP is currently operating only in Paarl and its activities include research, training and mentoring to prepare young people in South Africa for the business world, by equipping them with the character traits, life skills, basic business skills and continued mentoring, aiming to see them start and maintain their own successful small businesses. YEP students are trained on how to become entrepreneur, it is however a fantastic start for every young person in helping them understanding themselves and the big world of business out there. The YEP Project also provides wonderful opportunities for local businesses to offer internships to these enthusiastic newly trained young people whereby they can put in into practice what they have learned and gain some work experience.

Young Entrepreneur South Africa (YESA) is another youth entrepreneurship movement established for the sole purpose of creating an entrepreneurship eco-system in South Africa. YESA intends to put in place various programmes in place that further the objectives of the movement. The programmes are designed to promote thought leadership in the South African entrepreneurship eco-system. YESA was established following its official membership on Young Entrepreneur Appliance (G20 YEA), a global network of young entrepreneurs and the organizations that support them. G20 YEA was established with the aim of championing the importance of young entrepreneurs to the G20 member nations and to share examples and practices. Although the initiatives have been marked by some successes, there is still a need for more initiatives to service the much needed technopreneurs in the country. Therefore, this necessitated the need for universities, government and industries to further explore other alternatives avenues of promoting and developing more technopreneurs in South Africa.

Determinants of Successful Technopreneurship Development

Different factors need to come together and mutually support each other to be able to maximize the opportunities for innovation, growth and competitiveness, in a fully enabled knowledge economy, namely: the physical Information and Communication Technology (ICT) infrastructure, the skills needed to exploit the physical infrastructure, the business environment (factors such as the cost and ease of starting a business), and the innovation environment (e.g. university and firm collaboration, ability to bring new ideas to the market). This chapter thus identified major determinants that are believed to promote successful technopreneurship and these include digital and entrepreneurial skills, entrepreneurial mindset, digital infrastructure and entrepreneurial environment

Digital and Entrepreneurial Skills

OECD (2007) identified certain skills and attitudes that an entrepreneur should have to be effective and these include: persistence and commitment to achieving set goals, enthusiasm, self- confidence, propensity to take risk, creativity and innovation, change orientation and visionary. According to European Union (EU) Skills Panorama (2015), entrepreneurship is an individual's ability to turn ideas into action. It includes creativity, innovation and risk- taking, as well as the ability to plan and manage projects in order to achieve the stated objectives. However, for the purpose of this study, creativity, innovation and taking risk have been identified as major determinants of technopreneurship development process. Creativity is a process involving the generation of new ideas or new associations of the creative mind between existing ideas while an innovation is an idea, practice or object that is perceived as new by a unit of adoption

and carried out into practice (Rogers, 2003). Okpara (2007) define creativity as the ability of creating new ideas and innovative thought whereas innovation is the application of new ideas and believes that innovation can be a new product, new service or a new way of doing something.

Innovations and consequently, the innovation system may be considered a metasystem in which entrepreneurial activities become the driving force for the utilization of digital opportunities (Satalkina & Steiner, 2020). Drucker (1985) further argued that innovation is the tool of entrepreneurship and that both innovation and entrepreneurship demand creativity. OECD (2016) further described innovation as the implementation of a new or significantly improved product (good or service) or a process, a new marketing method or a new organizational method. Sternberg (2010) describes the nature of creativity as a confluence of interrelated resources, namely: intellectual abilities, knowledge, styles of thinking, personality, motivation and environment. Sternberg (2010) further suggested that the intellectual skills required for creativity include three particular skills: a synthetic skill to see problems in a new way and to escape the bounds of conventional thinking; an analytical skill to recognize which of one's ideas is worth pursuing; and practical-contextual skill of how to persuade others of the value of one's ideas. Creativity can be expressed as the intersection between three separate components, namely domain-relevant skills, creativity relevant skills and intrinsic task motivation (Amabile, 1998). Domain relevant skills include factual knowledge and expertise, technical skills and special talent; and intrinsic task motivation include self-motivation, enthusiastic, self-driven and commitment while creativity relevant skills include cognitive abilities, risk orientation, diverse experience and social skills (Amabile, 1998). Risk-taking propensity is a behavioural dimension of IEO which may drive pursuit of opportunities. Therefore, fostering creativity, innovation skills and risk taking among youth can play a crucial role in greatly advancing technopreneurship development. OECD (2016) further identified fundamental skills entrepreneurs needed for effective functioning including technical skills that entails the use of technological tools, techniques and procedures, to function in their digital field, and among others are internet skill, communication skills, environment monitoring, problem solving, technology implementation and use, interpersonal and organizational skills. Combination of all these skills can be viewed as enablers for technopreneurship development. Schwarzkopf (2016) also identified other core competencies of technopreneurship, namely: commitment, determination, leadership, opportunity obsession, tolerance of risk, ambiguity and uncertainty, creativity, self-reliance and ability to adapt and motivation to excel.

Entrepreneurial Mindset

Entrepreneurial mindset refers to a specific state of mind, which orientates human conduct towards entrepreneurial activities and outcomes. Individuals with entrepreneurial mindsets are often drawn to opportunities, innovation and new value creation. Entrepreneurs have about ten mindsets that actually make then successful in the areas of their endeavors, as pointed out by Hessinger (2018). These include the mindset on reaching out to customers first, finding a new market for an existing product, using networking to build their business, giving without expecting a return, keep control of their vision, understand the power of brand, focus their energy on what is good for their businesses, always maintain quality control and set their product apart and take ownership (Hessinger, 2018). Technopreneurship should therefore, strive for those entrepreneurial mindsets that could make them successful in digital business.

Digital Infrastructure

Technopreneurship has been described as digital technology tools and systems (i.e cloud computing, data analytics, online communities, social media, 3D printing, digital maker spaces, etc.) that offer communication, collaboration and computing capabilities to support innovation and entrepreneurship (Delacroix, Parguel & Benoit-Moreau, 2018). Digital infrastructure is one of major factors that affects technopreneurship in the 21st century. Cloud computing, digital maker spaces and data analytics have made it possible for new ventures to cost- effectively construct and test novel concepts, involving a larger set of potential customers, thereby showing the capability to support end-to-end entrepreneurial activities (Hatch, 2013).

Entrepreneurial Environment

From entrepreneurship perspectives, environment refers to external and internal conditions that affect or influence the business. Gnyawali and Fogel (1994) described the entrepreneurial environment as a combination of factors that play a role in the development of entrepreneurship, including the overall economic, socio-cultural and political factors that influence people's willingness and ability to undertake entrepreneurial activities. Entrepreneurial environment is therefore described as those environmental factors that influence and support technopreneurship. Environment changes from time to time and as a result it provides opportunities as well as threats to an entrepreneur's business. Technopreneurs should always analyze and understand the environment they are operating in, in order to know the business's strengths and weaknesses. Technological factor is one of the aspects of the business environment required to invent new designs, innovate and effectively use resources. With ICT, technopreneurs can have access to new knowledge, new processes of production, new strategy and better decision making. Cultural, political, legal, macro-economic and micro-economic environmental factors can also affect the entrepreneurial orientation of the pre-nascent entrepreneur.

Barriers to Effective Technopreneurship Development

According to Paramasivan and Selladurai (2017) it is challenging to develop or produce technopreneurs or to transform entrepreneurs into technopreneurial world, even though this is the perfect time to shape them to create a new atmosphere in the entrepreneurial field. Paramasivan and Selladurai (2017) further noted that if we are able to produce more technopreneurs, we can easily dominate the challengers with our technological entrepreneurs forever. However, one of the pivotal issues in South African government, industries and universities is a lack of a culture of promoting and supporting technopreneurship development. Young people with ground breaking ideas thumb suck because of red tapes and complicated procedures that they have to go through before receiving assistance from the few organizations that may be of assistance to them. Weak marketing channels and limited capital are identified as one of the major obstacles faced by young entrepreneurs in South Africa. Ghaz (2011) pointed out that awareness amongst these 'young bloods' with regards to assisting channels remained low. Technopreneurship requires innovation and individuals who understand Information and Communication Technology (Koe et al., 2018).

However, there are still many more barriers concerning youth entry into entrepreneurship that need to be addressed and overcome. Shambare (2013) identified the barriers that discourage entrepreneurship for South African students including: lack of interest in entrepreneurship, inappropriate syllabuses

and content, inappropriate teaching and learning methods, lack of entrepreneurial support and lack of exposure to the realities of what it takes to be an entrepreneur. Government and tertiary institutions have also put forth various efforts to encourage entrepreneurship among youth, however, many university graduates are lacking of interest in becoming entrepreneurs and developing young entrepreneurs remains as a challenging task (Hamidon, 2012). The lack of self-motivation could probably be explained by social and cultural attitudes, where a culture that is averse to taking risks discourages entrepreneurship (Herrington & Kew, 2017). Some of the key challenges faced by South Africa's innovation ecosystem and technopreneurship are described as follows:

Lack of Comprehensive Policy

There has been no comprehensive policy focusing on innovation and technopreneurship so far. The gravity of challenges South Africa is faced with, require multi-pronged efforts, that simultaneously promote the development of sustainable livelihoods, reduce poverty, inequality and prioritize the development of policies which create an enabling environment for youth development. South Africa must therefore create the environment favorable for young people to explore their concepts. Adopting policies able to drive convergence and synergies between the higher education system and companies leverages comparative advantages for some universities thereby enabling teaching to be complemented by research, which would suggest that this support variable, where not accelerated.

Inadequate Funding and Resources for Young Technopreneurs

Lack of funding or less funding is available for youth technopreneurship development to the academic and to Research and Development (R&D) institutions in South Africa. Even though funding is available from banks and public sources, however, the procedures for accessing such funding are often complex, lengthy and bureaucratic and not conducive to innovation and technopreneurship. It is likely that most start-up and emerging technopreneurs hit the administrative brick when they apply for funding or support. Infrastructure and resources also contribute drastically for young people to pilot their concepts as technopreneurs, infrastructure and resources, especially in rural areas. Basic infrastructure facilities such as electricity, roads and even the availability of a skilled workforce are not evenly distributed in South Africa and often weak in smaller towns and rural parts of the country. Therefore, there is less scope for innovation and technopreneurship to flourish in such areas. In most cases, innovators and entrepreneurs must travel long distances at their own expense to receive mentorship or other support. Internet connection is also a challenge in most rural residential areas; it becomes a stumbling block for young technopreneurs as internet play an important part in research and communication (Harper, et al, 2008). Abetti (1992) proposed some key elements that must be present to help entrepreneurs such as sources of technical expertise, availability of human resources and a variety of financing sources.

Weak Linkages Between Stakeholders

Universities, government and industries have an imperative role to play in fostering and providing continual support to technopreneurs, especially in developing emerging young technopreneurs in South Africa. However, the linkage between these three major stakeholders in South Africa is weak, and there is no easy exchange of manpower between the industries and academia which limits their capacity for

mutual understanding and technology transfer. In South Africa, there is much potential to grow the current handful technopreneurs. However, support structure (universities, government and industries) for aspiring and emerging technopreneur is keen and as a result, more still needs to be done to support start-up technopreneurs.

Lack of Awareness in Technopreneurship Development Opportunities

Majority of youth are unaware of some of the organizations aimed at supporting and developing technopreneurs in South Africa. Aspiring youth wanting to start their own businesses struggle to get accurate information, advice and direction. Government need to provide more promotional campaigns and conduct more training and awareness programs or initiatives to promote the entrepreneurial activities across the nation and to induce the entrepreneurs to become a technopreneur.

Lack of Appropriate Mentors, Coaches and Role Models

It is of the view of a researcher that mentors and coaches who have appropriate experience and have succeeded in their own right also have a positive impact on emerging and developing new technopreneurs. Mentors, coaches and role models must therefore support and guide the current frustrated start-up young technopreneurs in South Africa.

Non-Conducive Education System

As pointed out by Kumar (2017), embedding entrepreneurship in education and providing greater access are important steps for building an innovative culture and creating entrepreneurial individuals and organizations which in turn can create economic growth and jobs and can help to improve quality of life around the world. For example, the developing countries like Malaysia, Singapore, Philippines, Iran, India etc., are conducting a degree course called technopreneurship in Higher Education Institutions (HEIs). Technopreneurship education is thus a prerequisite to train the entrepreneurial ventures in the technical world. However, South African education system is not oriented towards innovation and technopreneurship. This situation is further worsened by the lack of infrastructure and good facilities in the educational institutions and delays or lack of funding in innovation projects.

Risk Aversion Among Technopreneurs

Young technopreneurs in South Africa often seek established technology as a basis for starting their business; they are hesitant to take on innovative ideas because of the risks involved, including the low availability and high cost of funds. As a result, the potentially higher returns from innovation and creativity take time to realize because not enough entrepreneurs are willing or able to take risks.

Role of University-Industry-Government in Developing Young Technopreneurs

Stakeholders (university-industry-government) tend to be viewed as important actors in entrepreneurial development as they provide a range of knowledge and other resources. The high rate of unemployment calls for government to work collaboratively with universities and industries to establish centers that

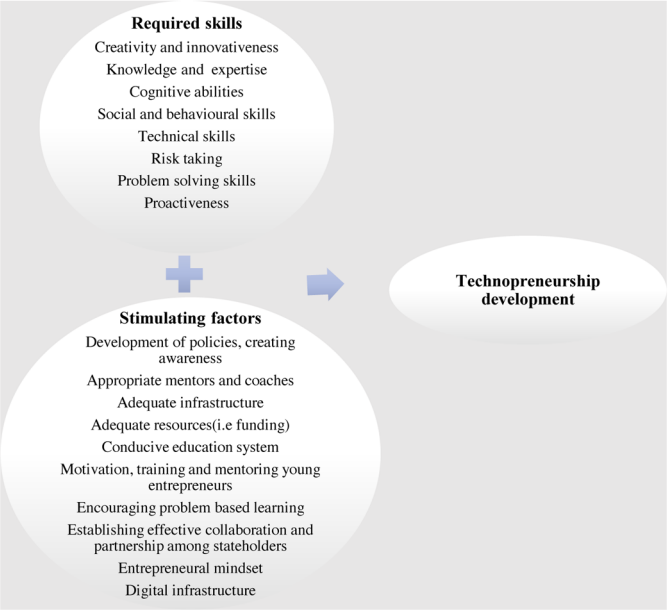
will fuel the process of supporting technopreneurs. The success of South Africa in developing technopreneurs is thus based on collaboration between university, government and industry structure which concentrated on creating and sustaining the necessary support structures to foster youth entrepreneurial activities through various initiatives. Governments around the world are constantly implementing new ways and methods to increase the number of technopreneurs. In Korea and China, entrepreneurial activity is also enhanced by the emergence of science parks and incubators, which mostly linked to universities (Lalkaka, 2002). Chinese incubators had helped bridge the gap between government research and the marketplace and had fostered entrepreneurial attitudes.

A study conducted by Colombo and Delmastro (2002) shown that Italian parks managed to attract entrepreneurs with better human capita, and entrepreneurs who undergone incubation programs performed better in terms of adoption of advanced technologies and establishment of collaborative arrangements with universities. As noted by Rothschild and Darr, 2003), in Israel, an innovation-based nation is created through the relationship between incubators and affiliated research institutions and this relationship has created synergy towards the success of entrepreneurial activity. Government in Singapore has also created favorable conditions to help technopreneurship to blossom by providing strong education system, infrastructure and free internet access (Burnett, 2000). Malaysia has also shown progress in entrepreneurship by having technology parks, Multimedia Super Corridor (MSC) and incubators to nurture start-ups companies. The success of developing and supporting emerging and aspiring technopreneurs fully depends on government-academia and industry to provide opportunities. It is important that universities in South Africa work hand-in-hand with government, industries and agencies that focus on innovation, technology and entrepreneurship. This will enable universities to utilize the agencies infrastructure and resources to further pilot student ideas into the real world. It is also important that incubators established must be visible and reachable to young people. The government must strive to make technopreneurship a trend, and also come up with exchange programs that allow young people from South African to receive training from well developed countries as this will expose young people to the world of technopreneurship. The Department of Higher Education Technology (DHET) must also re-engineer the current technology and entrepreneur module curricular to be relevant to the current socio-economic. This will enable young people from higher education to explore some of their own innovative concepts. South African education system must therefore allow students to be exposed to entrepreneurship and innovation at an early stage. Entrepreneurship module must include application questions that enable students to think and apply their minds. Technology and entrepreneur thus need to be introduced to the students at higher education institutions as are having the potential to produce cutting-edge innovative concepts.

A Proposed Model to Promote and Develop Young Technopreneurs

A conceptual integrated model was proposed in this study to assist in promoting and supporting technopreneurship development among youth. The model was developed from the literature review of previous studies and theoretical considerations based on the technopreneurship development best practices. Figure 2 thus shows a proposed conceptual integrated model for technopreneurship development, as summarized into two major areas, namely: required skills and stimulating factors.

Figure 2. A proposed conceptual model for technopreneurship development



Conceptual integrated model here is taken to mean logical linkage of key selected components that could be used to examine and understand the development of technopreneurship which include: technopreneurship development best practices, strategies and initiatives for technopreneurship development and factors enabling technopreneurship development. Several studies and research has been conducted but there have not been studies that are specifically targeted at identifying factors for a successful technopreneurship development, with a view to develop a conceptual integrated model.

SOLUTIONS AND RECOMMENDATIONS

The aim of the study was to assess the status of technopreneurship development. Although there is much potential to grow the current handful technopreneurs in South Africa, however, more still needs to be done to develop and support start-up technopreneurs. It is important that the three stakeholders (universities, industries and governments) work hand-in-hand with agencies that focus on innovation, technology and entrepreneurship. This could start with governments implementing policies on innovation and technopreneurship. Technopreneurship education should also be included in tertiary courses as this will enable youth to explore some of their own innovative concepts. Technopreneurship education needs to highlight the development of skills and talents required to generate a technical mind set and enable the future leaders to solve the complicated business problems. The barriers that hinder the development of technopreneurship thus need to be fully understood and strategies that enhance implementation need to be developed. A special platform should be created for the welfare of young technopreneurs and it must be a working playground for them to examine their business thoughts and implement new ideas. Exhibiting awareness campaigns on technopreneurship can easily develop the technopreneurial spirit in the individual's mind. Government should build the proper infrastructure and provide access to finan-

cial opportunities for the young generations. An agency that deal specifically with technopreneurship need to be established and work hand-in-hand with government, universities and industries, and also be reachable to ordinary people in most parts of the country.

FUTURE RESEARCH DIRECTIONS

The findings also provide evidence that cultivation of individual entrepreneurial orientation and Theory U can enhance the level of technopreneurship among youth. Although risk-taking, proactiveness and innovativeness are one of major drivers of technopreneurship, however, the concept of individual entrepreneurial orientation (IEO) which views risk-taking, proactiveness and innovativeness as entrepreneurial competencies has not been fully scrutinized in entrepreneurial studies. Further research is thus needed on exposure to the entrepreneurial process from a Theory U and IEO's perspective as a way to cultivate the mental models that shape young people's thinking and to build young entrepreneurs' capacity. This chapter confirmed the importance of studying EO at the individual level. Therefore, the elements of IEO, innovativeness, pro-activeness, risk-taking proclivity, environmental boldness and decision-making style, need to be investigated in future research, for the purpose of testing individual entrepreneurial orientation.

CONCLUSION

Institutionalized thinking in current education system hinders new teaching methods which are critical in imparting digital skills and the ability to learn them. Given the above challenges, South Africa need to create the environment favorable for young people to explore their ideas or concepts by providing strong education system, infrastructure, and resources (i.e. free internet access, technological infrastructure, funding etc.). There is therefore a need to actively encourage innovation, creativity and exploration in education. It is also suggested that higher learning institutions should pay careful attention in designing their entrepreneurship education curriculum that focus on enhancing youth's IEO ability and increasing their entrepreneurial intention. A comprehensive national digital skill strategies and policies need to be developed and implemented, and be shared at the national level in order to promote an enabling environment for youth employment and entrepreneurship in the digital economy. Government, industries and academia in South Africa must therefore continue working together and improve their infrastructure that it enables young people to execute their ideas. Current initiatives should also focus on boosting digital and entrepreneurship skills, improving access to resources and facilitating access to finance for youth.

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Chapter 11
Transformational Strategies and Implications for Digital Entrepreneurial Ecosystem

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ABSTRACT

Entrepreneurship has an effective position in the economic context. The positive impact of entrepreneurship on economic development, employment, and welfare in societies has increased the interest of different disciplines in the concept of entrepreneurship. The concept of digital entrepreneurship has emerged as a result of developments in digital technologies, especially internet technology. The increasing volume of electronic commerce has increased the interest in digital entrepreneurship because of the increased use of the internet and the impact of social media platforms. Digital entrepreneurship ecosystem encompasses all the elements that support the development of this field. In line with this information, the conceptual framework of digital entrepreneurship will be explained, and the technological applications within the digital entrepreneur ecosystem and how these applications support digital entrepreneurship will be explained.

INTRODUCTION

The concept of entrepreneurship, which is closely related to the economic development of countries across the world, has been a popular concept for many years (Acs, Estrin, Mickiewicz, & Szerb, 2018). The increasing importance of applications that create added value to increase strategic competitiveness in globalized trade makes the position of entrepreneurship concept decisive. The structural impact of entrepreneurship on the social and economic changes of nations further deepens the interest in this concept.

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The first person to use this concept in production factors was Jean Baptiste Say. According to Say, the entrepreneur is the main actor that manages the business by combining production factors (labor, capital, and land) (Schoorl, 2012). Entrepreneurship, in general terms, can be defined as the process undertaken to obtain earnings and added value, in line with certain conditions and economic risks (Acs et al., 2018; Sahut, Iandoli, & Teulon, 2019; Stam & Elfring, 2008).

While it has a considerable impact on the economy, entrepreneurship also plays a part in the sociological and psychological fields. These effects have increased the academic interest in the concept, as opposed to different disciplines. For this reason, entrepreneurship has taken its place in many social science studies such as economics, business administration, sociology, and psychology (Islam, 2020). These studies revealed the positive effect of entrepreneurship on employment, welfare, and sustainable development.

While entrepreneurship has come to the fore, digital entrepreneurship has emerged as a new type of entrepreneurship, especially with the astonishing development of digital and information technologies (Radicic, Pugh, & Douglas, 2020). The most important feature of the successful digital entrepreneurs is that they grow very fast and contribute to the economic development of the countries. On the other hand, when we look at the entrepreneurship literature, we can see a very mature theory and application infrastructure. But it is not possible to say the same thing for digital entrepreneurship since it is a very new field yet. Especially given this rapid transformation, we can say that it is still in the stage of maturation in the context of management and strategy (Elia, Margherita, & Passiante, 2020; Song, 2019; Sussan & Acs, 2017). The main purpose of this study is to contribute to filling this gap by analyzing this fast digital transformation that companies experience in the context of entrepreneurship strategically and managerially. In particular, it is aimed to shed light on both academic and practitioners through the use of digital and information technologies in digital entrepreneurship, and the strategies to be implemented in managing this ecosystem.

METHODOLOGY

In order to create the theoretical framework for the purposes of the study, several databases were used in the literature review. To search, Google Scholar was used with extensive research terms and different databases were reached. Articles, books, and conference proceedings from primary, secondary and peer-reviewed sources were scanned.

As search terms, going from general to specific: entrepreneurship, digital entrepreneurship, digital technologies, business ecosystem, entrepreneurship ecosystem, transformation, digital transformation, management, and strategies etc. the terms like were used with different combinations and detailed search options. In addition to the searches made with terms in the databases, studies related to the subject and purpose of the research have been reached with the snowball method. While evaluating the studies, the relevance of the journals to the field of research and the availability of up-to-date studies as much as possible were considered.

In this study, the following two questions were tried to be answered:

Q1: What is Digital entrepreneurial ecosystem?

Q2: What are the strategies to be applied in the creation, development and use of entrepreneurship ecosystems in digital transformation?

ENTREPRENEURSHIP

Entrepreneur Personality Traits

An entrepreneur is a person who bands together the required elements to create value within the margin of certain conditions and risks for producing goods or services and is vital for entrepreneurship to exist (Carland, Hoy, & Carland, 1988; Cornwall & Naughton, 2003; Gartner, 2016). Certain personality traits distinguish entrepreneurs from the rest of the population, which can be assembled under six subcategories within the current literature (Koh, 1996).

Being Success Oriented

One of the personality traits that an entrepreneur needs to have are the desire to realize the goals one has set, i.e. being success oriented. While the majority of people have vastly different ideas and goals, entrepreneurs are more successful in realizing their ideas and goals, owing to them being success oriented.

According to McClelland (1961), the need for success within the theory of need, the need to achieve has a psychological effect on entrepreneurship behavior. Consequent to the researches in this field, it was revealed that individuals with high levels of achievement motivation displayed a desire to prove themselves successful within the scope of calculable risks, while not taking any risks, great or lesser. It was also found out that individuals with this kind of behavior were deeply focused on their goals, and that they were always engrossed in something related to their goals. Another trait that success-oriented people showcase is being long-term oriented and being immersed in a medium-long term future as opposed to the near future (Bozkurt, 2006).

McClelland (1961) also presented a set of evidence that confirms the relationship between the development levels of countries and the achievement motivation levels that were measured in them. Within the light of his different studies, he described entrepreneurship as the tool that transforms the need for success to economic growth and development.

Willingness to Take Risks

The concept of risk has been consistently employed in many contrasting descriptions since the budding of the notion of entrepreneurship. The concept of risk is inherent to entrepreneurship. Entrepreneurs are willing to take certain risks to make use of opportunities and meet their goals. Studies have shown that one of the basic personality traits of entrepreneurs is willing to take risks.

The Locus of Control

This concept is used to describe the personality traits relevant to people's perception of the differences between their behaviors and the results of these behaviors and is usually divided into two categories: internal and external. Accordingly, the type of locus control people have, whether internal or external, creates real differences in the various parts of individuals' lives.

Those that attribute results of their behaviors to their personality traits and skills can be said to display internal locus control, while people who argue that the results of their behaviors are caused by external factors fall into the external locus control group. Individuals with internal focus control both feel and

think that they have control over their lives and that they can change the events surrounding them. Such individuals are more adept at establishing social relations and developing them. Studies have shown that internal focus control has a positive effect on entrepreneurship (Mueller & Thomas, 2001).

Being Innovative

Another personality trait that is attributed to entrepreneurs is being innovative. Several descriptions of entrepreneurship embrace this trait as one of the fundamental philosophies of entrepreneurship. As a direct result of technological developments, competition between businesses has become more strategic and this in turn, emphasized the importance of being innovative when it comes to businesses' abilities in maintaining their longevity against their counterparts in a competitive industry.

Joseph Alois Schumpeter, known for his studies on the correlation between entrepreneurship and the tendency to innovate, argues that for a person to become an entrepreneur, one has to at least accomplish one innovation in the given field (Hisrich, 1990). He further maintains that in times of economic stagnation, entrepreneurs will step in, come up with innovative ways, and reinvigorate the economy.

Tolerance of Uncertainty

Uncertainty can be described as the state in which one faces obscurity, lacks adequate information, or has little to no opinion about how events will unfold in a given situation. The behavior of developing indulgence and endurance against uncertainty is called tolerance of uncertainty. Entrepreneurship is inherently uncertain, as entrepreneurs undertake tasks accompanied by certain risks, knowing that they may face situations in which they cannot see the results. In other words, entrepreneurship takes place in an environment where uncertainty is the dominating force. Entrepreneurs are to be tolerant, i.e. indulgent against any uncertainties that they may face.

Self-Confidence

Described as believing in one's self, self-confidence is in direct proportion to one's success in all types of businesses and relationships, thus it is a vital personality trait for entrepreneurs. As it has a profound effect on an individual's motivation and performance, entrepreneurs need to always maintain a hopeful point of view and boost a high level of self-confidence against the risk that they confront them in an uncertain environment.

Types of Entrepreneurship

With the increasing interest in entrepreneurship and the effect of it becoming entangled in a vast number of fields, entrepreneurship has become more influential in today's world than ever before. The fact that each field takes a unique approach to entrepreneurship, emphasizing its different qualities, gave rise to many distinct types of entrepreneurship. The current situation of civilization and societies and their needs also affected their development. The following sections deal with the definition of widely accepted types of entrepreneurship and the differences between them.

Intrapreneurship

Intrapreneurship can be defined as the entrepreneurship activities that take place under an institution's or organization's roof. Pinchot, pioneering the concept, (Hisrich, 1990), describes it as the process in which employees of a business set forth and then apply innovations that can be put into action within the current business model in a given business function or on management related topics. To make way for new ideas and realize their next initiatives, the business needs to be innovative and have a visionary outlook both among employees and on a management level.

Corporate Entrepreneurship

Corporate entrepreneurship encompasses any small-scale initiatives within businesses, irrelevant of the size of their operations. It first appeared during the economically difficult years which started with the Great Depression of 1929 and persisted until the end of the Second World War. The main objectives of this type of entrepreneurship are to help SMEs prosper, maintain their sustainability, and to keep alive the spirit of entrepreneurship within the public.

Public Entrepreneurship

Public entrepreneurship is defined as the activity in which institutions that provide public services use their authority to take initiatives. The fact that entrepreneurs are supported and provided investments especially in times of economic recession with the help of the authority that rests on the public institutions, serves as proof of the benefits of public entrepreneurship. There have been many cases where initiatives formed through the support of public institutions caused a decline in the unemployment rate, while employment and home production levels were observed to show a gradual rise. There are some differences between public and individual (private) entrepreneurship. Essentially, public entrepreneurship is affected by the bureaucratic power balances, political rules as well as economic policies. And, while private entrepreneurship seeks profit, public entrepreneurship is aimed at public welfare.

Social Entrepreneurship

Social entrepreneurship is the approach that aims to improve social welfare by developing initiatives. Finding solutions to issues such as income inequality, economic instability, and problems related to health and environment forms the basis for social entrepreneurship. Improvements to the level of education, acceleration of democratization, and the rise in the accessibility to mass communication were made possible thanks to the increasing numbers of entrepreneurs.

Environmental Entrepreneurship

Environmental entrepreneurship appeared as a reaction to environmental pollution, i.e. solid wastes and air pollution resulting from the industrialization and the increasing population, during a time when environmental awareness was gaining momentum. It tries to find solutions to environmental problems and undertake the necessary steps, in areas that would further promote the recycling of wastes, production of natural products to especially prevent water and air pollution.

Factors That Affect Entrepreneurship

There are several internal and external factors that shape an individual's personality and behavior. These include but are not limited to the person's genetic code and their place of birth. Thus, the personality traits of entrepreneurs are affected by a number of factors such as family structure, socio-cultural structure, economic atmosphere, social environment, education and role models, etc.

-Family, being one of the most influential factors in the entrepreneurship tendency, plays an important role in the shaping of an individual's personality. Family members with entrepreneurship tendencies or members that have their own business positively impact individuals' entrepreneurship tendencies. Another factor that influences entrepreneurship is the economic situation of the family. Having a high economic standing within a family can have a positive effect in this respect. In addition, the family's level of education is another contributing factor. Families that can provide their children with entrepreneurship training courses naturally support entrepreneurship behavior.

The principles that a family instills their children while raising them is another factor impacting entrepreneurship tendency. Individuals raised by families that give unconditional support to their children, inspire them to be responsible and independent members of society with a mind for success are more likely to become entrepreneurs. Furthermore, families that allow and encourage their children to acquire experiences at an early age will help them become individuals with high self-confidence levels and such individuals will be one step ahead of their peers in becoming entrepreneurs themselves.

Culture is the sum of all material and nonmaterial values that are unique to a culture, which are passed down to future generations. These values include the way people live their everyday lives, their language, history, and moral code. As they exist within the boundaries of certain cultural values, entrepreneurs are inevitably affected by these same values.

One of the leading studies that can be cited in this respect is Hofstede's cultural dimensions theory (Hofstede 1989). In his study, Hofstede examines cultures in five different dimensions: Power Distance, Masculinity vs Femininity, Individualism vs Collectivism, Uncertainty Avoidance, and Long-term Orientation vs. Short-term Orientation. Subsequent to this study, further papers on cultural dimensions and entrepreneurship were published and a number of striking results were obtained.

Hofstede argues that masculine cultures focus on values such as success, competition, and ambition, while feminine cultures incline towards values such as sincerity and quality of life (Hofstede, 1989). Masculine cultures have better entrepreneurship traits and more entrepreneurs when compared to feminine cultures. Individualist societies were more suitable for entrepreneurship than collectivist societies. As people belonging to an individualist society value their ideas and interest above the collective gain, such societies are more prone to entrepreneurship activities.

In what Hofstede named as Uncertainty Avoidance dimension, people of societies that shy away from uncertainty try to secure their current position by avoiding any unknowns and risks. However, in societies with low uncertainty avoidance index, people are apt to take risks and are more at ease in the face of uncertain events. Thus, it can be concluded that in societies with high uncertainty avoidance index, people are less inclined towards becoming entrepreneurs as they are reluctant to take risks. While the opposite is true for countries such as the U.S. which have a low uncertainty avoidance index, where individuals have higher entrepreneurship tendencies.

Education is another aspect that affects entrepreneurship tendency and is vital for an entrepreneurship culture to exist within a society. The aim here is to train new entrepreneurs by helping them pick out and utilize current opportunities through entrepreneurship courses. These courses can improve the creativity

of young people, boost their self-confidence, and make them take responsibility by enabling them to perceive current risks. As the importance of such courses was realized, many educational institutions across the world, especially those in the U.S., started offering entrepreneurship courses to the public.

Age (Hisrich,1990) and sex (Zhang et al., 2009) were found to have an effect on entrepreneurship tendencies following researches on the subject. Accordingly, it was established that younger people displayed a higher level of entrepreneurship tendency, as they were more eager and energetic. As people age, they start paying more attention to how they spend their time and they take fewer risks, so interest in becoming an entrepreneur gradually diminishes. While young people have a higher entrepreneurship tendency, they should always take into consideration they lack adequate experience due to their age and should act accordingly. On the other hand, there have been many studies on the effect of gender on entrepreneurship. Some researchers argue that there are different tendencies between men and women in entrepreneurship (Zhang et al., 2009).

Role Models are another important influence worth mentioning when it comes to entrepreneurship tendency. Usually, individuals take people who are successful in their field as role models and continue their work by imitating these models. Entrepreneurs will be able to continue their entrepreneurship adventures with more confident steps by taking mainly their families, friends, and close circles as role models for themselves, refreshing their self-confidence and perseverance.

Digital Entrepreneurship

Cognitive developments that have taken place with the spread of the internet have caused great changes in many areas. Thanks to these technologies that were developed rather recently, it has been determined that there are wide-ranging changes from daily life practices to shopping routines. The fact that these changes are so deep has also made its impact on the economic and business structures of states. In line with these developments, entrepreneurs started to transfer their enterprises to digital platforms by using current technological trends.

Digital entrepreneurship, which can be expressed as the process in which entrepreneurial processes are affected by digital technologies, is the transfer of all or part of these processes into a digital environment (Du, Pan, Zhou, & Ouyang, 2018; Sahut et al., 2019; Sussan & Acs, 2017). Another definition of this concept refers to any entrepreneurial action that happens when all or a part of a product or a service is presented in a digital environment.

Data acquired from online activities in recent years has revealed the importance of digitalization yet again. The numerical size of retail e-commerce sales worldwide in 2018 was $ 2.98 billion. This already vast number reached $ 3.53 billion in 2019. When these figures are compared, it is seen that the retail e-commerce sector achieves an average of 19% growth per year. This figure is estimated to hit $4.2 billion at the end of 2020, and 6.5 billion dollars near the end of 2023.

Approximately 58% of the world's population actively uses the Internet. In other words, 4.57 billion people in the world are active users of the World Wide Web. Another important data to consider is the number of users on social media. A total of 3.81 billion people use social media worldwide. This accounts for approximately 49% of the World's population. The number of social media users increases by approximately 8.7% annually.

In 2019, the total number of mobile users worldwide was 6.8 billion. And The number of people using smartphones in the world was approximately 3.2 billion. While this figure was at a mere 2.9 billion in 2018, it is estimated that there will be 3.5 billion people active on social media by 2020.

From the figures listed above, it is understood that digital technologies, and the innovations brought by these technologies, have a significant impact on people's lives worldwide. The beneficial features of the Internet, social media, mobile internet, big data analytics, and cloud technologies are used as tools to create business opportunities and to collaborate with customers and partners. Based on their needs, enterprises can digitalize their business functions, ranging from production to finance, and supply chain management to customer relations management to further better their management and sustainability.

As a result of the increasing impact of digital technologies in the business world, countries give more importance and support to digital technologies and digital entrepreneurs to gain a competitive advantage on a global scale. Due to the growing value and the volume of digital technology entrepreneurship, digital entrepreneurs play an important role in areas such as innovation, employment creation, and economic development.

According to the data announced in 2019, seven of the world's ten most valuable companies are digital technology companies, which explains the importance of digital technology entrepreneurship. While only two technology companies could find their place among the ten most valuable companies in 2010, the acceleration of digitalization in the last 10 years enabled digital technology companies to dominate this list. Five of the digital technology companies in the top 10 are companies that are based in the U.S. (Apple, Microsoft Corp, Alphabet Inc., Amazon, and Facebook), while the other two are Chinese. (Alibaba and Tencent). When the economic effects of the mentioned digital technology companies are examined more closely, the importance of digitalization will be better understood.

Apple, which was founded in 1976, manufactures technological products that are frequently used by people such as iPhone smartphones, iMac computers, iPad tablets, and Apple Watch. Alphabet Inc was founded in 2015 to gather Google and other Google companies under one roof, which is the most frequently used search engine in the world. There are digital platforms frequently used by people such as Google, YouTube, Android, and Gmail under the company's name. Founded in 1994, Amazon is the world's largest e-commerce shopping site. Facebook was founded in 2004 and has frequently promoted digital applications such as Instagram and WhatsApp under its roof. The global recognition of the companies mentioned in the examples given above is quite high. This is an indication of how current daily life is intertwined with digital technologies.

Following the increase in the usage rate of technological innovations such as mobile internet, online communication programs, and social networking sites, there have been a number of changes in people's consumer behavior. People now watch television series and movies on online platforms rather than offline channels. They shop online and listen to music through digital platforms that offer music and podcast transfer services such as Spotify. Another factor that attributed to the rise of the digitalization of consumer behavior is the COVID-19 pandemic, which continues to affect the whole world. During the pandemic, people in their homes held online meetings, made purchases on websites, and the time spent on mobile games and applications increased significantly.

Internet technology and social media platforms offer businesses the opportunity to trade online. Businesses can sell any product or service they want by creating web pages or using their business accounts on social media platforms such as Facebook and Instagram. Thanks to the technological infrastructures of online platforms, more detailed target segments can be created and digital ads focused based on GPS information can be used. On the other hand; E-commerce activities can be realized more effectively thanks to digital marketing applications such as display advertising, search engine optimization (SEO), search engine advertising (SEM), and e-mail marketing.

As a result, digital entrepreneurship has become inevitable in the modern world. Digital fields are replacing the so-called 'soil' stage, the generally accepted phases of the economy such as labor, capital, land, and entrepreneurship. Today, the place of digital markets in new economic structures and national economic planning maintains its importance. Therefore, it should not be forgotten that societies that are closed to innovation are always out of the race. For this reason, digital entrepreneurship should be analyzed and implemented very effectively.

SOLUTIONS AND RECOMMENDATIONS

Entrepreneurship Ecosystem

The increasing positive effect of entrepreneurship on areas such as economic development, employment, etc. in recent years, and the better realization of this effect by countries around the world made it necessary to approach entrepreneurship as a system. And the integrated approach to entrepreneurship brought about the notion of the entrepreneurship ecosystem.

An ecosystem is a consistent system that consists of living beings in a certain area and their interaction with the non-living components in the surrounding vicinity. The need to approach certain concepts within the economic literature started in the approach to businesses and was soon followed by innovation and entrepreneurship. The fact that entrepreneurs are constantly in contact with internal and external environments leads to the development of the entrepreneurship ecosystem and its close examination.

In a most general sense, the entrepreneurship ecosystem is social and economic environments that affect entrepreneurship (Fernández Fernández, Blanco Jiménez, & Cuadrado Roura, 2015; Isenberg, 2011). As per the entrepreneurship ecosystem report of the Organisation for Economic Co-operation and Development (OECD), the entrepreneurship ecosystem is an integrated structure that encompasses a set of interconnected private entrepreneurial actors, entrepreneurial organizations such as banks and angel investors, institutions namely universities and public bodies, and the entrepreneurial process. To sum up, entrepreneurship ecosystem, led by and founded around the concept of entrepreneurship, involves cultural, economic, and sociological dynamics, etc. that are needed by a business to support its sustainability (Fernández Fernández et al., 2015; Groth, Esposito, & Tse, 2015; Isenberg, 2011; Rahatullah, 2013).

As the importance of the entrepreneurship ecosystem grew, the number of academic studies on the subject saw a rise, and consequently, a number of entrepreneurship ecosystem models were developed. While the elements involved in these models differ in numbers, most of them have some similar features as per the analysis of the studies. This section focuses on only two of these models that are widely accepted. The first model, which supports entrepreneurship, was developed by Isenberg and is divided into six domains: Human Capital, Markets, Policy, Finance, Culture, Supports. The second model, developed by World Economic Forum, divides the ecosystem into 8 main categories, each of which in turn is divided into a smaller varying number of further subcategories. The main categories are Accessible Markets, Human Capital Workforce, Funding and Finance, Support Systems, Education and Training, Major Universities, Cultural Support, Regulatory Framework, and Infrastructure.

Human Capital

The human factor is the basis for entrepreneurship to flourish. Most of the factors that affect entrepreneurship, mainly entrepreneurs and the like are human-based. According to the studies, the element in the entrepreneurship ecosystem that has the most profound impact on the growth and sustainability of entrepreneurship are qualified individuals.

Human capital should not only be limited to entrepreneurs. Team staff that supports the entrepreneurs and the businesses that they set up, people who provide support and consultancy, and the suppliers, accountant, etc. constitute the human capital. Education institutions and the business world in countries around the world work in tandem to develop the entrepreneurship ecosystem and train a qualified, visionary, and innovative human capital.

- **Funding and Finance:** Financial resources are essential for entrepreneurs to achieve their goals. They need funding to realize their ideas and start their businesses. Despite having passionate ideas, most would-be entrepreneurs fail to start their entrepreneurship journey due to economic concerns. The sources that can supply entrepreneurs with the required funds needed to start within the immediate environment, namely the family and friends. Then it stretches to angel investors, venture capitals, crowdfunding campaigns, and credit institutions.
- **Family and Friends:** To realize their ideas, entrepreneurs usually seek funding from their immediate surroundings, which often happens to be their family members and their friends. This source for funding is the most fundamental one, and it offers low risk and high reliability as it rarely entails contracts or sanctions such as interest.
- **Angel Investors:** These individuals typically provide funding to initiatives that they deem promising during their establishment or growth stage, and they become business associates with entrepreneurs. On top of funding entrepreneurs, angel investors usually share their experiences, knowledge, and business networks that they have accumulated to guide budding entrepreneurs. Studies have shown that entrepreneurs value angel investors' experiences as much as the funding that they provide. Grasping their effect on entrepreneurship, countries have started to provide economic and legal gateways to support angel investors. As stated by the Angel Capital Association, there are currently over 14,000 thousand angel investors in the U.S.
- **Venture Capital:** Described as a form of investment funding that enables the financing needs of new enterprises to be met, the main property of venture capitals is that they are investments made with the aim of gaining high returns from enterprises with high risk and high growth potential. High return in exchange for high risk and long term, separates venture capitals from other financing methods. Venture capital investments are generally made at growth stages and in higher quantities, not at the establishment stages. It is carried out institutionally through funds created by people or businesses.
- **Crowdfunding:** It can be defined as the financing of enterprises through the internet. It is a digital finance resource that enables entrepreneurs to obtain the financing they need through online platforms. Entrepreneurs can reach the masses through digital platforms such as websites, social media platforms, and obtain the financing they need from those who are interested in their initiative on these platforms.
- **Credit Institutions:** One of the resources entrepreneurs can benefit from when financing their financing needs is credit institutions, especially banks. In order to support entrepreneurship, coun-

tries try to provide the entrepreneurs with the funding that they require to start their businesses via banks while easing interest rates on loans and extending their time.

Accessible Markets

The concept of the market can be defined as a set of conditions in which buyers and sellers interact freely and goods or services change hands freely between buyers and sellers. It is the opportunity in the market that drives the entrepreneur to action. Therefore, the concept of the market is one of the important components of the entrepreneurship ecosystem. The presence of markets formed by the target group of the entrepreneur, the size of the market, the competitive structure in the market, and market access conditions are the issues that the entrepreneur should focus on.

Support Systems

One of the dynamics of the entrepreneurship ecosystem is support systems. It includes elements such as mentors, catalysts, techno parks, entrepreneurship networks, and communal areas to continue their activities after the formation of entrepreneurship. Initiatives, like a person needing those around them while starting to flourish, need support systems from the establishment stage until they are fully mature.

- **Mentors-Consultants:** This term refers to the people with a certain amount of experience, knowledge, or expertise, who contribute to someone else's personal or professional development. Mentors guide people with their experience, give information, and show how to get the job done. It is a kind of master and apprentice relationship. The mentor helps people who request information about the processes that they had experienced in their own lives. Entrepreneurs also need the support of mentors. The presence of mentors who have experienced the challenging processes of entrepreneurship will help new entrepreneurs to overcome the challenges they encounter in entrepreneurship processes more easily, and the entrepreneurship process will progress more efficiently. Consultants are another support element of the entrepreneurship ecosystem. The consultant is the person whose consultation, knowledge and expertise are consulted on a job or a subject. Entrepreneurs, while continuing their entrepreneurship activities, benefit from consultants on subjects they do not possess knowledge. When an entrepreneur decides to set up a technology-focused venture, he can get the necessary support from companies that provide consulting services in areas such as law and marketing.
- **Incubation Centers:** These are the facilities that provide office services, equipment support, management support, access to financial resources, critical business and technical support services under one roof, especially in order to develop young and new businesses. In short, incubation centers are the first stage guides of enterprises. These services and consultancy services provided to entrepreneurs in incubation centers are vital for the sustainability of enterprises.

Incubation centers make an important contribution to the realization of innovative ideas of lecturers, students, and entrepreneur candidates by promoting the cooperation between universities and the business world. They can be established under the umbrella of the universities or the private sector, of which are many examples of incubation centers around the world.

- **Acceleration Programs:** This term refers to any type of aid established to help entrepreneurs grow rapidly and effectively. Some types of acceleration programs include mentor networks, easy access to funding, training courses on specific skills, and interactive workspaces the entrepreneurs require. The main difference between incubation centers and acceleration programs is that incubation centers support initiatives that are in the initiation phase, i.e. idea stage, while the acceleration programs are generally created for entrepreneurs who have already realized their projects.

Acceleration programs, which are the driving force behind the newly established initiatives, are programs that are planned within a curriculum that aims at continuing their activities effectively for a few months. The most effective accelerator program worldwide is called Y-Combinator.

- **Technology Development Zone - Techno park:** The technology development zone, where companies with the vision to apply new technologies, make use of the opportunities of a certain university or high technology institute, produce technology or software, operate to turn a technological invention into a commercial product or service, and thereby contribute to the development of the region they are located in. This term also includes sites where academic, economic, and social structures are integrated into or are near to universities or high technology institutes or similar areas with these features.

The aim of such places is to develop new technologies, increase efficiency, commercialize technological information, provide employment and contribute to technology transfer by ensuring cooperation between universities, venture companies, and other sectors through technology development areas.

- **Entrepreneur Networks:** One of the subcategories that make up the support systems within the entrepreneurship ecosystem is the entrepreneurial networks. It is the name given to social organizations created by mentors, angel investors, consultants, or venture capitalists to support new entrepreneurs. By creating entrepreneurship networks, it is aimed to support the activities of entrepreneurs and increase the effectiveness of the entrepreneurship ecosystem.
- **Communal Areas:** Based on the gathering of entrepreneurs in a physical space, these areas are created for the entrepreneurs to work more efficiently thanks to a closer environment. Their main purpose is for entrepreneurs to mentor and help each other with different ideas and with their expertise.

Education

One of the dynamics that make up the entrepreneurship ecosystem is education. Education is very important to increase the effectiveness and number of entrepreneurs, increase awareness of entrepreneurship, and make the entrepreneurship ecosystem more integrated. According to the world economic forum, entrepreneurship education is divided into three main stages:

- Pre-university entrepreneurship education
- Entrepreneurship training at universities
- Entrepreneur-specific training

An effective entrepreneurship policy can only be achieved through the adoption of entrepreneurship culture, a better analysis of the existing opportunities, ensuring that people can take risks, and increasing the number of entrepreneurs as a result.

Regulatory Framework and Infrastructure

Another sub-category that forms the entrepreneurship ecosystem is the regulatory framework and infrastructure. According to the world economic forum, the regulatory framework and infrastructure are the following: ease of establishment, tax incentives, employment-friendly legislation/policies, access to basic infrastructure (e.g.: water, electricity), telecommunications (broadband access), and access to transportation. Facilitating entrepreneurs while establishing their companies to start up their businesses, putting into force a specifically designed legal infrastructure, promoting entrepreneurship in tax policies, and providing access to basic infrastructure services to entrepreneurs without any effort are environmental conditions that will improve entrepreneurship and entrepreneurship ecosystem.

Cultural Support

In countries where entrepreneurship culture is developed, it is observed that the perspective on entrepreneurship is positive, tolerance to risk, and failure is encouraged, successful entrepreneurs are rewarded and are role models for entrepreneur candidates, and R&D activities are supported.

Universities

Universities play an important role in the entrepreneurship ecosystem. Thanks to the entrepreneurship training provided at universities, young people are more apt to choose entrepreneurship as a career option. As a result of these courses, individuals' creativity will be increased, and opportunities will be more accessible to them. Furthermore, entrepreneur trends will be created by changing their perception of taking risks. Universities enable knowledge to spread thanks to their academic staff and are at the heart of the entrepreneurship ecosystem. The accumulated knowledge is transferred to the youth and who in turn can start their entrepreneurship journey in the light of the information they have obtained. In addition, universities are able to increase the efficiency of the entrepreneurship ecosystem with their technology transfer offices, incubation centers, and techno parks.

Following the dynamics and explanations that make up the entrepreneurship ecosystem, various comments can be made in line with the reports prepared by international organizations and a comparison can be drawn on the entrepreneurship performance of the countries. The first report worth mentioning in this respect is the report prepared by the Global Entrepreneurship Network (GEN) in 2019, which compares the based on the dynamic entrepreneurship index. According to the data in the report, the United States is in the first place with a ratio of 66.8. Finland follows as the runner up with 64.6 and Netherlands in settles just after that with 64.4. The countries that followed the top three were Singapore, Germany, Sweden, Switzerland, Ireland, Canada, and the UK, respectively.

Another report comparing the entrepreneurship levels of the countries was published by the Global Entrepreneurship and Development Institute (GEDI). Published in 2018, the report compared the effectiveness of entrepreneurial ecosystems in each of the 137 countries and presented an outlook on each country's success in both local and international entrepreneurship endeavors. According to the data

obtained, the United States is the leader in the list with 83.6 points. Switzerland is second with 80.4 points and Canada with third place with 79.2 points. The first three countries are followed by England, Australia, Denmark, Iceland, Ireland, Sweden, and France, respectively.

Another similar report on the entrepreneurship activities of countries that has international validity was published by the Global Entrepreneurship Monitor (GEM). This report, which compared the countries according to the National Entrepreneurship Context Index (NECI), consists of a total of 12 components: entrepreneurship financing, government support and interest level, taxes and bureaucracy, government programs for entrepreneurs, entrepreneurship education at school, entrepreneurship education after school, R&D transfer, commercial and legal infrastructure, domestic market dynamics, market load, physical infrastructure, and cultural and social norms. According to the Entrepreneurship Context Index, Switzerland leads the list with 6.05 points. The Netherlands ranks second with 6.04 and Qatar is in third place with 5.91 points. These countries are followed by China, the United Arab Emirates, India, Taiwan, Indonesia, Norway, and the United States, respectively.

The European Index of Digital Entrepreneurship Systems (EIDES) report prepared by the European Commission, which attempts to measure the impact of digitalization on the entrepreneurship ecosystem in European countries, is another report that should be examined. In addition to entrepreneurship ecosystem measurement indices, the digital entrepreneurship stand-up sub-index, digital entrepreneurship start-up sub-index, and digital entrepreneurship scale-up sub-index are added. According to the results of the report, the country with the highest digital entrepreneurship index in Europe is Denmark with 80.7 points. Sweden is the second with 75.6 points and Luxembourg is the third with 74 points.

The data presented above from the reports of international organizations reveal the perspective of countries on entrepreneurship and the effectiveness of entrepreneurship ecosystems. Many sub-elements employed in the preparation of these reports are the summaries of the entrepreneurship cultures of the countries. The United States, which usually ranks first in the report rankings, is the best example of a country highly successful and effective entrepreneurship ecosystem thanks to having a social structure and a government, as well as financing resources and education policies that support and encourage entrepreneurship.

Silicon Valley is the best example of the successful practices of the United States in regard to entrepreneurship. Being one of the centers of entrepreneurship and technology, it includes many companies operating worldwide and is also the first techno park in the world. Initially founded to Stanford University academicians and students to provide technological developments, has become the technology center of the world today. The economic size of Silicon Valley, where many digital technology entrepreneur companies and many entrepreneurs are located, is bigger than the economy of many countries in the world. Silicon Valley, which is home to many world giant companies such as Google, Apple, HP, Facebook, Oracle, is the most important techno park to be examined on the effective entrepreneurship ecosystem.

Digital Entrepreneurship Ecosystem

Digital technologies have influenced many dynamics, from business models to business processes, from people's communications to the routines of everyday life, and it also had an impact on entrepreneurship and the entrepreneurship ecosystem. The influence of digital technologies on the entrepreneurship ecosystem gave rise to the concept of the digital entrepreneurship ecosystem.

The digital entrepreneurship ecosystem is an autonomous entrepreneurship association that creates processes at all stages of entrepreneurship, consists of complex services, and can offer digital opportuni-

ties by directly benefiting from the system itself (Acs, Stam, Audretsch, & O'Connor, 2017; Du et al., 2018; Sussan & Acs, 2017). Although different definitions are made for the digital entrepreneurship ecosystem, which is a fairly new concept, it generally expresses the whole social, economic and technological environment that should be found in order to establish and continue a digital enterprise. Unlike traditional entrepreneurship, the necessity and vitality of technological facilities and infrastructure for digital entrepreneurship are obvious.

Although there are many studies and accepted models on entrepreneurship ecosystems, it is a new concept compared to its peers and thus, there are no widely accepted researches on its modeling. When the literature is examined, it is seen that a framework consisting of four components is drawn for the digital entrepreneurship ecosystem: digital user citizenship, digital entrepreneurship, digital infrastructure governance, and digital marketplace (Sussan & Acs, 2017). In a more recent study, these components were discussed as digital user citizenship, digital technology entrepreneurship, digital infrastructure governance, and digital multisided platform (Song, 2019). In this study, as per the stated theoretical framework, the digital technologies and their applications will be explained, according to the classification in the entrepreneurship ecosystem.

Education and Human Resources

Digital technologies have contributed to many developments in the field of education, one of the elements of the entrepreneurship ecosystem. Thanks to the development of digital technologies, educational activities started to be carried out online, and the recent Covid-19 pandemic further instigated the digitalization of many daily life routines, especially education. As a result of these developments, Massive Open Online Course (MOOC) platforms started to emerge. An unlimited number of users can receive courses on the internet through these platforms. Leading universities in the world such as MIT and Harvard have been offering courses through these platforms. There are many massive open online course initiatives in the world such as Coursera, Edx, Udemy. These courses provide a thorough training program on digital entrepreneurship or technical and social issues that supports it.

Human resources activities, another element of the entrepreneurship ecosystem, have also experienced many changes in the light of digital technologies. Digital talent acquisition is, now, at an important position for the human resources policies of digital companies. Businesses are also trying to implement more effective human resources policies by making use of the opportunities offered via digital technologies. They use application tracking systems and recruitment software such as Greenhouse and employ e-mail systems such as RocketReach. In addition, digital initiatives such as Persenio are frequently used by businesses in human resources processes. On the other hand, for their human resources needs, entrepreneurs can reach people who can work both freelance and from the comfort of their homes in different parts of the world. Through sites such as Github, individuals can be involved in software projects and can benefit from these platforms in sharing information, experience, and solutions.

Investors and Financial Supports

Digital technologies have also affected investor and financial support activities in the entrepreneurial ecosystem. As a result of the increase in entrepreneur interactions, online platforms have started to be created in order to obtain funding sources. Crowdfunding, which is one of the types of investment and funding, provided entrepreneurs with the opportunity to obtain funding by reaching many people with the

help of digital technologies and online platforms. Some of the crowdfunding platforms are Crowdcube, OurCrowd, SeedInvest, Indiegogo, and Arıkovanı, where entrepreneurs can meet their financial support needs. In addition, entrepreneurs can meet their financing needs through online angel investor platforms such as Angel Effect and AngelList. There are also online platforms with venture capital investors such as MicroVentures. In particular, given that some digital enterprise projects can be based on the technical skills and specific information of individuals (such as developing a mobile application), entrepreneurs can find funding that offers rather small amounts of support, such as microloans, and they can offer their products to the market. It is of critical importance for young entrepreneurs to find this relatively small capital, especially in underdeveloped and developing countries. Another point to further strengthen the spirit of a beneficial ecosystem is to make application, approval, and payment solutions for loans and other funding methods free of bureaucracy and easy to access.

Finance and Payment Tools

Another effect of digital technologies has been on finance and payment tools. Financial Technology (FinTech), which emerged with the use of technological innovations in the financial field, is an innovation that enables financial services to be performed on digital platforms. Consisting of personal financial management, smart payment technologies, virtual currencies such as Bitcoin, blockchain technology, digital finance tools such as banking and investment, FinTech is a sector with serious growth momentum. The financial technology industry has digital tools such as mobile banking, digital wallet, asset management, money transfer, and POS systems. Brazilian-based next-generation bank Nubank, San Francisco-based Chime, London-based Monzo, and Vienna-based Vaningo are examples of financial technology initiatives. Digital payment tools such as Paypal, eBay, MasterPass, Visa Checkout, BKM Express are examples of platforms used within the scope of financial technology. Payment tools provide convenience not only for the cost of goods or services received but also for entrepreneurs to pay their employees or the organizations they work with.

Technology and Security Infrastructure

The fact that digitalization has affected many sectors brought security concerns along with it. As a result, the concept of cybersecurity has emerged to protect digital data. Cybersecurity initiatives are operating worldwide, i.e. as Tenable, Lookout, and CloudFlare. Security technologies are vital for the protection of all parties in an environment where many activities and payments occur online. In an environment where one of the parties feels insecure, the functioning of the commercial might be disrupted leading to parties shying away from further transactions.

Marketing and Distribution Elements

Thanks to digital technologies, significant developments have occurred in the field of marketing. As a result of the increasing use of the internet and social media, businesses can sell products or services to their target audiences through their websites and social media accounts. While these online commercial activities are carried out, businesses can perform their activities more effectively via digital marketing tools such as display advertising, e-mail marketing, social media marketing, influencer, SEO, SEM, and analysis-reporting.

Distribution policies have seen plenty of changes with the development of new digital technologies in areas such as planning of product movements, shipment, delivery, collection of product prices, return goods, route planning, vehicle tracking make processes less cumbersome. Digital technologies such as e-logistics software, vehicle-fleet tracking systems, barcode, and radio frequency identification systems, order management systems, transport management systems, and warehouse management systems have enabled the logistics industry to operate more efficiently. Global logistics companies such as DHL Express, FedEx, and UPS have been applying technological developments efficiently for some time.

Another important issue within the scope of distribution is that entrepreneurs who have goals such as software or application development and who cannot find adequate support can use larger and widespread platforms in the process of introducing, promoting, and distributing their products to the market. For example, entrepreneurs who develop mobile applications commonly use AppStore and Play Store platforms. Also, they may need different applications or software solutions especially for the promotion, optimization, and similar activities of their products.

Legal Regulations

One of the ecosystem elements required for the sustainability of entrepreneurship is legal regulations. Governments should decide on necessary legal arrangements for the promotion of entrepreneurship. In today's world, where digitalization affects all areas of life, governments need to enforce legal regulations to ensure data privacy, intellectual property protection, and data protection to support digital entrepreneurs and enable secure operations of online activities.

On a side note, countries and legal regulations should especially strive to prevent leading technology companies around the world from becoming a monopoly that cut off small entrepreneurs or that condemn them to operate in their interest within certain limits. Governments should be more aware and willing when it comes to taking the necessary actions to prevent entrepreneurs that plan to use the infrastructures and platforms of other known companies during their digital entrepreneurship activities from being exploited, and they should as well strive to create an actively controlled and acceptable competitive environment.

FUTURE RESEARCH DIRECTIONS

In this study, management strategies and applications for digital entrepreneurship ecosystem are presented in a general framework. It is obvious that this transformation will have different applications and strategies for other business functions (eg marketing, production, logistics, accounting etc.). However, these are not included in the scope of this study. How this separate transformation will be differentiated for different sectors may be the subject of future studies. On the other hand, since the subject of digital entrepreneurship ecosystem is a very new field, both theoretical and empirical researches are needed in this regard. We believe that this kind of research will shed light on academics and practitioners and fill the gaps in the literature.

CONCLUSION

In light of the explanations above, the effects of digital technologies on entrepreneurship and the entrepreneurship ecosystem we discussed, and global digital entrepreneur examples were given for each sub-category in the ecosystem. As a result of the development of internet technologies and transportation technologies, enterprises will be able to operate more easily on a global scale. With customer segmentation and customer relationship management, as well as data analysis provided by digital technologies, customers can be classified based on their region or country, and better localization efforts leading to more successful operations can be achieved (Muñoz, Kibler, Mandakovic, & Amorós, 2020). The increased acceleration of developments in digital technologies brings with itself many positive and negative conditions for entrepreneurship. A good understanding and efficient analysis of these conditions is a must for entrepreneurship to succeed in the digital age.

The necessity of digital transformation for companies is now an indisputable issue. However, it is vital for companies how this transformation will take place, what strategies will be implemented and how it will need to be adapted administratively. In this study, the issues that companies should consider for this transformation are presented in a theoretical framework.

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KEY TERMS AND DEFINITIONS

Digital Entrepreneurship: Any entrepreneurial action that happens when all or a part of a product or a service is presented in a digital environment.

Digital Entrepreneurship Ecosystem: Whole social, economic, and technological environment that should be found to establish and continue a digital enterprise.

Entrepreneur: A person who bands together the required elements to create value within the margin of certain conditions and risks for the purpose of producing goods or services and is vital for entrepreneurship to exist.

Entrepreneurship: The process undertaken to obtain earnings and added value, in line with certain conditions and economic risks.

Entrepreneurship Ecosystem: The social and economic environments that affect entrepreneurship.

Intrapreneurship: The entrepreneurship activities that take place under an institution's or organization's roof.

Locus of Control: The personality traits relevant to individuals' perception on the differences between their behaviors and the results of these behaviors.

Chapter 12
The Fourth Revolution: Strategies to Manage Artificial Intelligence to Transform Economy and Society for the Digital Age

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ABSTRACT

Technological breakthroughs are the reasons for industrial revolution to occur. However, it may take time to exert its effects on social and technological domains. Artificial intelligence is the branch of computer science which tries to replicate human intelligence in machines that are programmed to think like humans and mimic their actions. It is acquiring increasing importance in industrial application, revolutionizing the entire industrial system enough to be referred as "Fourth Industrial Revolution." This chapter describes the impacts of artificial intelligence on the economy and society at large. Specifically, it analyzes the enablers and barriers behind the automatization of the working force and how the digital transformation may entail opportunities and challenges for the current economic and working dynamics as well as for society in general.

INTRODUCTION

When we think about Artificial Intelligence (AI), we often think of it in the future tense. However, while we are thinking about all the potential changes that have yet to come, we are missing all the ways AI and robotization have already transformed our lives. Learning, logic, reasoning, perception, and creativity

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are all aspects of human intelligence that are now being replicated by technology (Ligeza, 1995). These qualities that were once deemed as unique to humans are now being stimulated through machine learning, and need to be strategized around by enterprises.

The spread of AI has been largely enhanced by the diffusion of digital technologies. In fact, AI and digitalization are not one and the same but building blocks of one another, they are complementary elements. AI lives and breathes through data and the integration of data (Cappa, Oriani, Peruffo, & McCarthy, 2020; Ghahramani, 2015). Often referred to as machine learning, AI is redefining what can be digitized, amplifying the use of data to make more informed decisions (O'Leary, 2013), and promoting successful strategies and business processes that replace human behavior. It is transforming enterprises and society as we know it.

Digital transformation has a strong link with AI but in order for the evolution of these technologies to grow we need for enterprises and actors within the society to incorporate radical different strategies and adopt innovative business models (Helfat & Raubitschek, 2018; Teece, 2018). Digitalization has been born through a social culture, has thrived through a marketing culture and has been fostered by an innovation culture. Digital transformation is what connects touchpoints for a consumer and allows for a consistent experience across all digital platforms and even some physical ones. From there AI acts as an extension to better learn and adapt from data and systems integration.

Robotics and AI are growing at a dramatic pace. European Commission data shows that globally we will spend in 2020 $188 billion on robots, a significant increase with respect to 2016, when the spending was slightly more than half. At the same time in five years from now (2025) we expect the AI global market to grow to $59 billion, up from the $1.8 billions of related spending that characterized 2016. Together with the higher productivity growth that robotics and AI are expected to trigger, these growing markets will also generate certain challenges for enterprises and societies (European Commission, 2019).

What do such technological trends in AI and robotization entail for the future of work? Which jobs will be destroyed, and which new ones created? In such context, what role do enterprises, institutions and education systems will need to play to manage and navigate the related societal transitions?

There is an urgent need, for both enterprises, institutions and other actors within the global ecosystem to channel increasing attention on how this transition is being managed. With a clear acceleration in technological swift, change management is key and should be implemented across all enterprises and societal systems. Our focus should not be on what changes are coming, but how we can better organize as a society to manage and successfully take advantage of these new technologies, thus designing ad hoc strategies to navigate this transformation.

There is a natural inclination to view this ongoing revolution in a pessimistic way due to the mass changes that are occurring and the constant disruptions technology is triggering in the society. However, we should channel our efforts and attention on the opportunities that AI and robotization will unveil in the very next future and formulate recommendations to efficiently and effectively grasp such opportunities. In doing so, this chapter focuses on the challenges arising from automation and provides some paths that enterprises and actors in the society can walk to transform these challenges into opportunities and render their strategies successful in long-term perspective.

RESEARCH METHODOLOGY

To allow digitalization and AI to thrive in society, economy and organizations, beside the formation of a new work category, a proper up-skilling and re-skilling of the workforce is required (Becker & Gerhart, 1996).

In this respect, we build on the human resource development framework (Swanson, 1995). The framework is composed by two dimensions: training and development, and organization development. This means that the personnel training and development depends also on the ability of the organization to promote the employee training. In our chapter we build on these two dimensions to theorize about the impact of AI and digital technologies on economy and work and their implications on society.

In particular, we use data provided by recent reports from the European Commission (2012; 2019) and bundle them with literature in the field (Colbert, Nick & Gerard, 2016; Swanson, 1995) to identify guidelines and recommendations for companies and governments in the adoption of the emerging digital technologies and tools. Although these findings result from theoretical argumentations rather than empirical analyses, we still believe they represent an useful starting point to encourage actions and research in this direction, with the aim that different actors in the ecosystem may be ready to embrace this fourth revolution.

BACKGROUND: HOW LABOR MARKETS REACTED TO PREVIOUS ECONOMIC TRANSFORMATIONS

Historical Trendline

Historically, every revolution has displaced workers and transformed our economies (European Commission, 2019). Whether we look at these revolutions in the short term or long term, automation inevitably leads to new and better job functions (Bonekamp & Sure, 2015). The present-day fear of the elimination of jobs builds on the ancient struggle between technological development and societal changes. However, if we look at the historical trendline we can agree about the undeniable positive impact innovation has made, while creating more value adding positions within the workforce and society.

Each wave of automation has been connected to shifts from agriculture to manufacturing and finally to services (Acemoglu & Restrepo, 2018). The first shift was the one characterizing the agricultural field in the 18th and 19th centuries. Farmers migrated to factories, resulting in a decrease in the share of employment in this field of about 37% in between 1840 and 1960 and in a subsequent increase in the share of manufacturing (Lee, Davari, Singh, & Pandhare, 2018; Li, Hou, Yu, Lu, & Yang, 2017). Due to these revolutionary shifts, society found that by increasing automation it could also boost productivity, thus threatening the essential role of workers in specific sectors. Similarly, enterprises active in the service sector moved towards what we now see as experiences being sold rather than physical products. Enterprises such like Uber and Seamless have built their strategies around the idea of "servitization" (Frank, Mendes, Ayala, & Ghezzi, 2019), thus also creating jobs that do not anymore revolve merely around products, rather around shared experiences and services. This movement into services has created new job lines and several new opportunities to be exploited by enterprises and individuals with different skillsets and accessibility.

Due to these revolutionary shifts, society found that increased automation led to a boost in productivity and reduced the need for workers in a given sector (McKinsey & Company et al., 2017). However, when we look at the impact automation has had on jobs and employment, we must make a distinction between short-term and long-term effects. Let's take the US and the EU example: in the US, the share of manufacturing in total employment experienced a decrease of about 16% between 1960 and 2017 (European Commission, 2019), while in the EU the reduction was slightly greater, around 20% between 1970 and 2017. These countries saw an increase in productivity which decreased the relative costs of manufacturing and overall improved the living standards. Due to robotics and advanced automation, manufacturing became a machine-oriented process, thus creating a decrease in jobs and increasing the threshold for productivity (Fantini, Pinzone, & Taisch, 2020). This increase in productivity allowed for factories and plants to produce at higher numbers and quicker, which in return lowered costs for enterprises and allowed for a better living standard. Automation also enabled a migration of resources to other sectors, thus increasing the production of other goods.

Although in the short-term automation has the ability to displace workers within a sector, we must keep in mind the historical trends mentioned which lead us to believe that, in the long-term and across the economy, chances are for enterprises that are able to strategize around the digital transformation to benefit from this revolution, also spurring a growth in the overall employment.

The Fourth Industrial Revolution

It is hard to say where we are regarding the digital revolution timeline, however we know it is not nearly close to being done. It all began with mobile internet connectivity, laptops and smartphones, and has continued to grow at an accelerated rate (Zhou, Liu, & Zhou, 2016). These technologies paved the way for greater amounts of data to be collected and used for both businesses and government purposes. Without the digital revolution transforming society and connecting people across devices and platforms, AI may lack the strong foundation it needs to make transformational applications. The fourth revolution is all about harnessing the power of AI and making data driven decisions (O'Leary, 2013). Now more than ever governments, enterprises and society need to create adequate infrastructures to support the amount of data at their disposal, also implementing strategies and adopting business models that enable them to successfully handle this massive pool of data generated by the recent digital transformation. It is not enough to just "have" data anymore, but enterprises, governments and actors within the society must have the resources and capabilities to use it adequately, at speed and in conjunction with its software and services.

Even though we have established that job displacement is not an issue in the long-term, it does however have an extensive impact on the labor market in the short-term. The severity of the impact this fourth revolution can have all depends on the pace and extent of adoption of AI technologies. McKinsey (McKinsey & Company et al., 2017) points to five major elements impacting on the pace and extent of adoption:

1. Technical Feasibility: invention of a specific technology, that is then integrated and adapted into feasible business solutions.
2. Cost of Development and Deployment.
3. Labor Market Dynamics: supply, demand and costs of human labor in lieu of automation.
4. Economic Benefits: increased quality, labor cost savings.

5. Regulatory and Social Acceptance.

Economic Shifts

The impact AI and robotics will bring to the economy still remains unclear. This revolution has brought many positive changes and we hope the benefits it has triggered will last. However, the potential of these changes is uncertain and widely disruptive. AI and advanced robotics are built off of other digital technologies, amplifying the possibility of disruption and making the future of these technologies extremely hard to predict.

When we talk about the fourth revolution, there are three economical drivers affected: globalization, digitalization, and atomization. Globalization has changed the world as we know it. Our markets are no longer run by larger multinational conglomerates which enabled a steady flow of products. Now we are looking at the steady flow of services that are being provided not only by larger multinational companies but smaller enterprises as well. Smaller companies, which account for 80% of European exports (European Commission, 2019) now have the ability to compete on a global scale and do so by adopting international strategies that span their country boundaries and embrace consumers and partners worldwide. Notwithstanding globalization triggered several benefits, such as spurring mobility and profitability for enterprises and individuals, it also sparked the same fear this technological revolution has: the loss of jobs.

However, in the same way AI and automation have created more value adding jobs, globalization has done it as well. Relocation and the creation of new jobs in the services sector has made up for any potential loss. The second key driver is digitalization. We have all in one way or another experienced technology that has replaced what once was a human interaction. These forms of automation have created an exchange of tasks between workers and machines. Such exchange is giving room for radically new business models and strategies to emerge (Teece, 2018), whose core is the interaction between machines and actors of the ecosystem. Nowadays workers can channel their efforts on the development of more complex tasks, while machines perform the more rudimentary tasks. These changes are meaningful for the economy, as we are experiencing a boost in productivity and enterprises are able to ensure better customers' services and adaptations of several jobs. Economic atomization is also a key component in this economic shift.

As previously mentioned, the integration of globalization and digitalization has created a space in the market for small and medium businesses to appear strong and to take advantage from their fluid routines. This has led to an increasing number of SEMs and micro online businesses. With this influx of companies into the market the economy is stimulated by many businesses from around the globe, instead of just by a few in more developed countries.

A NEW ECONOMY: THE IMPACT OF DIGITALIZATION AND AUTOMATION

Our economy, for some time now, has been fueled by technology. It has changed our everyday lives either by making them more efficient or by causing us to adapt to new and different ways of living. Right now, we can say that our society and our economy is heavily relying on technology. During the Coronavirus pandemic, we are seeing increased use of technology and transactions. We are seeing that companies

with remote capabilities are able to keep on performing despite abrupt exogenous shocks that have forced them to transform their usual way of doing business.

Even without a global pandemic, we can see the impact of automation on economy and enterprises. Traditional companies have changed their strategies dramatically due to the technological revolution. As previously mentioned, we are seeing more creation of new jobs with higher value and the adaption of old jobs combined with machines. More importantly, this revolution has brought the uprising of a whole job sector, the IT.

While the IT sector is not new, looking at the figures, the advent of digitalization has generated millions of jobs: specifically, in the last 10 years, it has enabled the creation of more than 2 million jobs in the EU, with a 1 million increase from 2013 to 2016 alone. In the IT sector, there is a shortage of skills, and the sector is expected to hire 800,000 more workers by 2020 (European Commission, 2012).

A New Workforce

Development of New Services

While the IT industry is growing at full speed, we are also seeing a large impact to the economy coming from e-commerce. We have all watched the brick and mortar stores closing down while internet-based companies took their place, navigating the transformation thanks to strategies that valued experiences and services rather than material products and goods. In this context, e-commerce has become a fundamental component to our economy (Abebe, 2014). Companies have adapted to the trend brought about by the digital transformation. They have started focusing on selling online, exploiting the potential behind such new way of delivering value to customers. E-commerce has created worldwide jobs in logistics, product design, marketing, while also introducing a whole new line of services. Amazon, Netflix and Spotify are great examples of that. Amazon has introduced many robotic and machine-driven elements into its processes and logistics; but at the same time, they have expanded the need for warehouses, thus creating new jobs in the sector. Amazon brought tremendous growth to its sector and in return we saw economic and societal gains. Spotify and Netflix introduced the era of streaming, changing the mindsets of consumers and businesses alike. These services also introduced AI to consumers by recognizing a user's likes and dislikes and pushing out recommendations and creating more personalized platforms. Spotify and Netflix were no longer products of movies and music, they were an experience. Each song that is downloaded and each show that is binge watched creates data that are then stored within the company's cloud computing software that then in return creates a better, deeper experience for that customer. This was a huge turning point for many companies when they realized the extent of what data could do and how it could move their strategies to a whole new level and create more value for their consumers and partners.

New Ways of Working

The diffusion of digital platforms has significantly impacted the working environment. These digital platforms make it possible for people to coordinate transactions in a digital marketplace and allow consumers to buy in easy ways and at cheaper prices several goods and services (De Reuver, Sørensen, & Basole, 2018). Moreover, platforms determine an increase in employment in the industry, both for traditional employees who provide such goods and services and for the newly autonomous workers that

work on the platform. Platform work has to do with, for example, services provided from home (i.e. Twago or Clickworker), mobility services (i.e. Uber), or services working in somebody else's home (i.e. Taskrabbit).

Just as the streaming services, these digital platforms allowed for greater accessibility to the marketplace and introduced new forms of working. Improved access to digital infrastructure has been instrumental in the 'boom' of digital platforms. People are able to buy and sell more easily, distant and part-time work are more normalized and customers within the market become more accessible. Digital platforms are providing new and different opportunities for the labor market and slowly bringing formalization to the economy.

These new and different ways of working can also be looked at as different types of entrepreneurship, which refer to self-employed individuals. The association of digitalization with digital entrepreneurship can be examined by looking at the types of individuals who will have a superior advantage in being an entrepreneur based on their skillsets. It can be argued that individuals in ICT occupations have the strongest exposure to digital technologies and may be more perceptive to opportunities rising in this context (Fossen & Sorgner, 2019). With digital technology and automation creating such a large disruption in the workforce and the economy, entrepreneurship will play an important role in the transition periods where jobs are becoming obsolete (Baptista, Stein, Klein, Watson-Manheim, & Lee, 2020). In these moments, individuals will turn to entrepreneurship as a viable alternative to unemployment along with mid-aged individuals who are switching occupations and hold university degrees (Fossen & Sorgner, 2019).

Entrepreneurship will prove to be a steppingstone for many who will ultimately be replaced by robotization and automation (Stentoft, Adsbøll Wickstrøm, Philipsen, & Haug, 2020). While many will have advantages due to their previous jobs and educations, the ability and availability to use the new technology and digitalization will propel individuals into new and profitable business ideas. However, those who lack the necessary skills to become an entrepreneur may find themselves at a disadvantage. This is why continuing education will be so important for the future of the workforce. As mentioned, service jobs and platform work are great opportunities to be self-employed, but they do not give individuals the exposure to learn and adapt to the changing technological environment.

In the following section, correlations between the news ways of working and the education system will be made. The education system and the workforce operate hand in hand to develop and train individuals to continually stimulate the economy. To only rely on individuals who conveniently find themselves at a technological advantage would be a mistake. It is up to our education systems and employers to push for better training opportunities, offering ad-hoc up-skilling programs in line with our current technological situations and nurture the minds of all individuals by providing the necessary materials and guidance.

Looking for a Proper Education

The Readiness of Education Systems

While evidence suggests that the digital revolution has created more jobs than it destroyed (European Commission, 2019), the critical topics that need to be addressed by future research are, among others, the new skills and competencies that need to be implemented into the education systems to avoid their models become obsolete. The jobs the technological revolution has created are proven to be higher in quality, yet, require new and different skills that we as a society still lack. It is up to the education systems

to make realistic and drastic changes to what is being taught and stress the importance of these changes. The role of the education system will be paramount in this transition.

The way the education system is built today fails to address the changes brought on by new technologies. Currently, schools and companies are focused on educating the younger generations and ensuring they are ready and able to enter the workforce. However, it lacks focus on transversal skills and on the education of adults. Education should shift towards a more continuous flow of learning, and thus both public organizations and private enterprises should adapt their strategies to fully embrace the transformation that digital technologies have triggered (Bonekamp & Sure, 2015).

With automation and AI reshaping not only the way we work, but also the skills needed to work, it is important that we focus on the short-term transition and begin to anticipate which skills will be needed. According to The World Economic Forum, it is possible to close the skills gap by acknowledging, on one side, the country's or industry's skills base today and, on the other, what are the skills that this digital transformation will require in the very next future (World Economic Forum, 2011). Indeed, such transformation will probably render technologically skilled workers pivotal within the workforce and thus within the enterprises that will populate our future. As such, students can develop educational skills in Science, Technology, Engineering, and Mathematics (STEM) subjects and leverage them to be competitive in the workforce, thus also enabling the companies they are employed within to be competitive in the marketplace. Developing such skills has to be considered essential for countries and industries, particularly in view of the low levels of proficiency nationwide and large achievement gaps. However, while recognizing how critical is to develop analytical thinking skills whose boundaries encompasses multiple subject areas, providing students high-quality instruction in the STEM subjects is only part of the solution to preparing them to be an active part and play a pivotal role in the changing workforce (Levesque, 2018).

To complete the education puzzle, we not only need to prepare our students and future generation workers with the correct skills and knowledge, but also provide a continuous learning platform that allows people of all ages and all skills, to better adapt and transition in our ever-changing technological landscape.

The Role of Work-Based Learning Programs

Work-based learning programs take on many forms (co-ops, apprenticeships, etc.), and they have proven to be a valuable source in the development of skills due to their combined approach of the classroom and work-based learning (Rubin, Fernandes, Avgerinou, & Moore, 2010). Both workers and employers benefit from apprenticeship style programs. Workers receive a proper skills-based education that allows them to be in the market for a well-paying job, while companies' employers find a stacked market full of ready and able professionals for their picking. The future of education is leaning more and more towards this type of education system due to the constantly shifting technological world we live in today. The skills and resources being hired today and incentivized by many companies may not be what is needed tomorrow.

Work based learning programs have a strong correlation to the fourth revolution due to the many new skills and technologies that are needed within the workforce. More importantly, these programs are needed to educate people on how to adapt and learn the new skills and technologies that are still unknown and yet to come. As mentioned, we are seeing the IT sector take off, but in order for it to continue developing, and in order for companies to be successfully thrive in the future, we need skilled people

and resources. Work based learning programs will give human resources the chance to "catch-up" and learn the dynamics of this "new" technologically advanced world.

The Role of Online Learning

Online learning has been considered as a transformative technology, as it can widen access to higher education, decrease the cost of delivery and overcome capacity constraints (Gallego & Topaloglu, 2019). Online learning is vital during the fourth revolution due to the evolution of skills that are needed within the workforce (Rubin et al., 2010). With greater accessibility, people from around the globe can begin to be trained in diverse skills through a screen and AI can make this more efficient for both the students and the educators. The potential of online learning and the availability of new, digitally sophisticated, training tools represent a huge opportunity also for enterprises in the sector and outside the boundaries of the educational industry. Indeed, these actors may leverage on them to develop strategies to better engage their employees and build strong relationships with their partners and consumers.

For online learning to make a greater impact, educational institutions and companies need to begin to shift into the digital atmosphere. But not only do they need to become more digital, they need to start the integration of AI and automation. With the advancements of AI, educators have a whole new meaning. Advances in automated assignment grading and remote monitoring services (i.e. Proctorio) free up educators from their normal repetitive and time sensitive tasks, giving them time to interact with students in a more value-added way. "For students that don't thrive in the regular classroom setting, AI-enabled learning management systems (LMS) can deploy surveys to categorize individuals into distinct learning buckets (e.g. visual, auditory, text), which can provide effective and targeted content that fits with each preferred learning style. Beyond just identification of preferences, the platforms can also break down long-form lectures and reading assignments into smaller, atomic components that are easily digestible" (Pranam, 2019). Of course, moving education to an online platform does have a downside. Students will no longer interact (face-to-face) with other students and classrooms can no longer simulate real world activities. This in return can negatively impact students' learning and hinder their potential.

THE SOCIAL DIALOGUE

Renewing the Organization of Work

It is clear that education systems, companies and the workforce have and will continue to transform in drastic ways. Now, more than ever, it is important to renew the way work is organized and establish a new set of norms from the top down. Work of the future must fulfill three requirements: innovation, productivity growth and economic security.

Rebalancing Fiscal Policies

Looking at the current fiscal policies within the US, there are clearly more incentives designated towards capital investment rather than human resources. Due to these incentives, companies that invest in machine powered devices and new technological advancements (that in the end replace humans) are seeing benefits of low marginal rates on capital income, rapid rates of depreciation on plant and equipment

investments and lastly often directly subsidized capital investments. With that being said, the value of human resources is being diminished due to the great extent of incentives aimed at capital investment and almost none aimed at human resources. Additionally, the tax rate for human capital investments greatly exceed the tax rate on capital investments. This imbalance in taxation may encourage companies to substitute, where possible, workers with tax-subsidized machinery (Acemoglu, 2019).

With such policies in place, the opposite impact of what is needed is and will take place. We will see more workers become displaced, technology will dominate, and firms will continue to replace workers with technology for the remaining future. It is understood that some of the technologies replacing human resources do create large benefits to the firm and to society, however, new value adding roles need to be created in the place of this loss. While on one side companies need to adopt new strategies to navigate this transformation, thus also changing their employment hiring and training practices, on the other side new policies also need to advocate and incentivize the use of highly skilled workers within them. Once policies fall in line, firms will begin to act in the appropriate way and bring balance back to the employment process. However, as mentioned before, these policies will only have a positive impact if the education system can supply the market with the correct labor resources. This is why governments and the education systems need to work closer together and adapt more efficiently.

Fostering Innovation

Innovation is a key area to be focused on throughout this revolution. However, the focus cannot primarily be on the type of innovation that has put us in our technological predicament, but on the type of innovation that compliments the workforce. It is important that the private sector is supported in a significant way. Firms should look to increase know-how through investments in organizational capacities that boost innovation and integrative capabilities as well as productivity (Helfat & Raubitschek, 2018). Several different industries (i.e. manufacturing and healthcare) are examples of how it is possible to boost productivity benefits by integrating and appropriately manage technology with complementary innovations and capabilities (Kakatkar, Bilgram, & Füller, 2020; Paschen, Pitt, & Kietzmann, 2020).

The management of a firm is a skill that highly impacts the output a company makes. This output is directly impacted by the input it receives, whether that be skills, technology or effort. Firms need to measure their inputs and outputs to further understand where innovation is benefiting their workers and where things are falling flat. In order to move forward in such a dynamic environment, it is paramount that firms realize the necessity to balance their strategies and business models on both human resources and innovation to ensure the two can work together in a highly efficient and productive way (De Vita, 2015; Fantini et al., 2020). "With a greater computational information processing capacity and an analytical approach, AI can extend humans' cognition when addressing complexity, whereas humans can still offer a more holistic, intuitive approach in dealing with uncertainty and equivocality in organizational decision making. This premise mirrors the idea of intelligence augmentation, which states that AI systems should be designed with the intention of augmenting, not replacing, human contributions" (Jarrahi, 2018:577).

This is a transformation that will take time and will be fought by those who fear change. It is important that the management of a firm communicates clearly to all of its employees the changes that this transformation entails. It is also important that firms employ within their lines highly trained change management professionals to guide the digital transition on a smooth path. The transition should start from the top-down and be completely transparent. In this way, the top management of smaller teams will be fully educated on the continuing changes and employees will feel much more comfortable through the many

transitions to come. It is true, jobs will be replaced, titles will be changed, and new technology will be integrated, but it can, and should all be to direct the firm towards business models and strategies able to generate increasing long-term value for employees, actors of the ecosystem and the future of technology.

SOCIETAL IMPLICATIONS

To see a positive impact on our economies through the AI revolution, we need to take into account what are the effects in terms of societal transformation (George, Howard-Grenville, Joshi & Tihanyi, 2016). For example, it will be crucial for enterprises, governments and actors within the ecosystem to be able to manage short-term labor market transitions. The transitions, adaptation and skill requirements workers will face will be a significant challenge in this new AI age (Helfat & Raubitschek, 2018). We find ourselves in a complex evolution where the jobs lost are not simply replaceable by the new ones created. What will also influence the net effect of automation on job creation is the pace at which displaced workers can be retrained and migrate towards newly created jobs (European Commission, 2019).

Also, it will be key for institutions and governments, as well as for companies and individuals, to acknowledge the gap such revolution may exacerbate at a societal level. Unfortunately, what is likely to happen is that the perks of the digital transformation come to be experienced by the wealthiest nations and populations, with negative consequences for people living in the poorest parts of the world who do not have access to infrastructures and lack systems that are adequate to leverage on this technological revolution. This means that, while part of the world will start running at a dramatically faster pace, the other half will increasingly struggle, and this will exacerbate global inequalities and move us away from the goals of sustainable development that, as humanity, we promised to reach (UN, 2015).

As mentioned at the start of the chapter, it is common for people to view this revolution in a pessimistic way. In terms of impact on jobs, we see media often creating alarming headlines about workforce experiencing drastic changes, thus filling people with uncertainty and fear for the future. However, it is also true that the technological transition we are experiencing leaves room for workers to find their true passions and take advantage of the numerous new opportunities that are being presented. It is up to people to push themselves into new dimensions of the workforce and grasp onto this new world. AI and advanced robotics will pose many challenges to society, but it will also allow for humans to focus more of their attention on different kind of tasks, such as the ones that builds on empathy and out-of-the-box thinking. After all, when workers execute jobs they find engaging, happiness and job satisfaction are expected to increase.

In terms of society and the possibility to grant our planet a sustainable future, we are starting acknowledging all the good such transition may entail (Chui et al., 2018). We see more and more AI and machine learning applications that can help solve societal challenges, with technologies representing for us the guide to build a better future. While it is true that we are witnessing several massive societal challenges, it is also true that we are nowadays able to build machines and tools to face these challenges. If we think about climate change and its impact on management (Howard-Grenville, Buckle, Hoskins & George, 2014), we notice that while few years ago we did not have feasible and appropriate alternatives to burn fossil fuels and stop the upward trend in temperatures characterizing the last decades (IPCC, 2018), nowadays things have significantly changed.

We have technologies that enable us to produce sustainable and affordable energy from natural resources, we have machines that allow us to reduce pollution and increase crops' productivity while

preserving the nature, we have enterprises that are leveraging these technologies and machines to generate added value for the society. By building on the new technologies and digital tools of the 4.0 revolution to foster the creation and adoption of renewable sources of energy we cannot only fulfill our goal of granting worldwide access to affordable, clean and sustainable energy (United Nations, 2015), but we can also improve educational systems (reducing educational divide by providing adequate infrastructures to students and educators all around the world) and foster the development of smart and sustainable cities and communities (Cappa, Laut, Nov, Giustiniano, & Porfiri, 2016).

Also, this digital revolution can trigger specific advantages within the healthcare industry. Just think about the current circumstances of COVID-19 which are rendering healthcare a topic that is top of mind. People around the world, in quarantine or not, are learning the benefits of in-home care and self-care. In a time where it is dangerous to be around other people, AI, digitalization and automation are changing and even saving our lives. With advanced technology, people can begin to "self-care." New technology allows for medical advice and medical capabilities to be accessible through a smart device from the comfort of your own home. One of the main benefits of AI is the reduction of human error: such reduction is highly important within the medical field. AI can efficiently diagnose and predict disease at faster pace with respect to most medical professionals (e.g. an AI model using algorithms and deep learning diagnosed breast cancer at a higher rate than 11 pathologists, as in Thomas, 2020).

Smartphones have also made a large impact within the healthcare industry by granting greater accessibility to real doctors through the phone or supplying patients with virtual medical assistants. One of the most common forms of AI that is used within many sectors is the chatbot. The healthcare industry invented a chatbot that listens to a patient's symptoms and concerns and then guides the patient to the proper form of care, treatment plan or diagnosis. This AI based system is called Buoy Health and uses algorithms to treat illness (Thomas, 2019). This is just one of many ways AI is changing the healthcare system. Additionally, AI can make revolutionary changes within the operations of healthcare facilities by lowering costs (saving money) and being more widely accessible to a larger population of people. With more advancements happening every day, McKinsey predicts big data could save medicine and pharma up to $100 billion annually (McKinsey & Company et al., 2017).

In sum, although this fourth revolution may be beneficial in several ways (Teece, 2018), we are still far from embracing and developing its full potential. There are several positive changes that can be triggered with the technological advancements we are making: we can create new, more stimulating jobs, we can try to fight the climate emergency that is threatening us, we can start more socially oriented enterprises and businesses, we can build more resilient, smart and sustainable cities and communities, we can save more lives and ensure better and more equal education systems. There is a lot we can gain from this digital revolution. The flip side of the coin is that, unfortunately, there is also a lot to lose if, as individuals, companies, government and societies, we come to be unprepared when the impetus and intensity of the revolution overcome our ability to manage it. The following paragraph is meant to provide some guidelines in this direction.

SOLUTIONS AND RECOMMENDATIONS

To move forward during such a transformative time, we need to accept the uncertainty of the economy and the constant changes we will face in every aspect of our lives. To navigate this revolution we need to reshape, rebuild and relearn together. This means that:

- Companies should transform their business models and adapt their strategies to embrace the digital transformation and the technological tools it provides in order to generate added value not only for themselves but also for the society as a whole.
- Educators and talent managers need to be prepared to teach and hire new skills and keep students and younger generations up to date on the changes within specific fields of interest.
- Secondary education curricula need to be changed so students can learn how to learn and relearn (overall adapt) new and different skills depending on the environment.
- Education systems need to put more emphasis on flexibility and a combination of basic skills so that one day the students can blend their skills together (i.e. science and technology) and be better prepared.
- Degrees/diplomas should no longer hold such strong value but instead skillsets and expertise. Job descriptions should clearly state what skills are needed for a given job.
- Adult education needs to be a stronger focus and more widely accepted. Firms should adapt their strategies to give all employees access to educational platforms and training so that even mid-career professionals can stay up to date and not go obsolete within the workforce.
- AI & advanced robotic hubs should be created around the world to supply knowledge and expertise to companies and different actors within the society. Researchers and pioneers should come together to experiment, build and share findings and make society a better place through information and technology.
- No company should be without AI specialists. This new breed of talent will be highly needed to help with adaptation and will provide greater mobility/flexibility.
- Government policies should align better with innovation and begin to create more complimentary plans for both human and societal resources and the development of AI technology, thus embracing the digital transition but at the same time safeguarding individual and societal needs.

In the table below (Table 1) we summarized the challenges this digital revolution will trigger and the strategies that organizations may implement to face and manage these challenges.

FUTURE RESEARCH DIRECTIONS

The changes mentioned above are good first steps, but it will take time and much investment to proceed in the correct way. While some of these steps have already been implemented or are on the horizon, continuous fine tuning and adapting is needed. The next phase of this revolution will be to begin to better predict new developments and begin to close the skills gap within the AI era.

This is why it is key for researchers and practitioners to engage into studies that provide individuals, enterprises and institutions with the directions needed to stand in the face of the revolution we are experiences and the future paths it may draws. It is important for future research to delve into the skills and training that individuals need to adapt to the changing working environment and that companies need to leverage onto to be competitive in the long-term. Also, it is critical to develop future studies that build on a broader perspective, one that consider the societal implications that may be triggered when companies and institutions adopt and exploit AI and related technologies.

Table 1. Challenges arising from digital transformation and organizational strategies to cope with them

Challenges Arising From Digital Transformation	Organizational Strategies to Manage Digital Challenges
Need to embrace digital tools and technologies.	Business model transformation to incorporate digital tools and technologies.
Need to develop adequate skills and competencies to face digital transformation.	Prepare individuals, managers and employees with ad hoc training programs.
Traditional education systems become obsolete.	Develop joint programs with public and private educational institutions to promote new learning methods.
Grant inclusion of different stakeholders and communities, and create social impact alongside the economic one.	Work with institutions and other actors in the ecosystem to implement strategies that embrace the pillars of sustainability, responsibility and ethics.

CONCLUSION

As this chapter has shown, our economy is facing major changes and the progression of AI is not slowing down. More and more human tasks are being replaced by robotics and automation and are largely going unnoticed due to the relative normalcy of it. However, it is silently creating anxiety and insecurity for many workers and companies. We can say that these feelings all stem from the big bubble of uncertainty and the unknown of tomorrow. From this chapter, two things have become very clear:

- Any resistance to the advancements of AI technology and robotics will only cost us more, it will slow down adaptation and cause workers, companies and citizens to become less competitive.
- Our look back on history foreshadows that time and time again our societies fail to transition economically, specifically when faced with technological disruptions.

A heavy focus on transition is needed. We need to reorganize and rethink our organizations to move towards more horizonal structures, more flexible ones. Additionally, as individuals, companies, institutions and communities we need to significantly invest in research, education, IT infrastructure and systems (some countries have already showed that they are prioritizing this). Also, we need to adopt a new educational logic, that targets adults, that focuses on learning rather than on technical knowledge that can quickly become obsolete (European Commission, 2019).

This is the revolution where we do not need to lag behind and fail to adapt. It is time to use our technology, lean on globalization and reeducate our people and companies to create a better society. Artificial intelligence is not meant to hold us back but propel us forward with strength.

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KEY TERMS AND DEFINITIONS

Artificial Intelligence: Branch of computer science which simulate of human intelligence in machines that are programmed to think like humans.

Creation of Social Impact: Fostering initiatives and activities that aim at benefiting society at large, increasing the well-being of different stakeholders and communities.

Digital Transformation: The application of digital technology to every aspect of services or businesses, substituting non-digital or manual processes with digital processes or replacing older digital technology with newer digital technology.

Learning Management System: Software application for the administration, documentation, tracking, reporting, automation and delivery of educational courses, training programs, or learning and development programs.

Machine Learning: The application of artificial intelligence (AI) to provides systems the ability to automatically learn and improve from experience.

Robotization: Automation of a system or process by use of robotic devices.

Servitization: Process of building revenue streams for manufacturers from services.

Chapter 13
Banking Perspective of E-Commerce and Digital Enterprise Transformation

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ABSTRACT

Digital enterprise transformation facilitates financial services organizations via enabling them to be more secure, compliant, as well as being digital. It modifies the experience of employees, partners, customers, and stakeholders. The contemporary world is changing very rapidly as information technology has redefined e-commerce. In its simplest sense, a baseline definition of e-commerce can be the performing of business by engaging computer networks and telecommunication aspects. In a narrow sense, e-commerce is pertinent to the commercial sphere involving transactions and people relate it to buying and selling via the internet. On a broader spectrum, it has a wider range of multiple activities. The specific definition thus used in this research curtails it as being an activity performed via a telecommunication network or the internet, which is a component of business model that generates profits and also involves selling. It might be any one of the following: information, products (physical or digital), and services.

INTRODUCTION

The respective work focuses on exploring the banking perspective of e-commerce and Digital Enterprise Transformation in contemporary era. The objective of respective study is to highlight as well as critically analyze the significant role of e-commerce and the use of Digital Enterprise Transformation to ensure customer acquisition in a secure manner. To an extent, this study will facilitate in filling previous gaps of other studies as it focuses on exploring multifaceted aspects of e-commerce, Digital Enterprise Transformation with respect to the banking sector.

Nations worldwide have recognized the developmental opportunities and challenges of emerging information age characterized by Information and Communication Technologies (Allen, 2019). These

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technologies are now driving national development worldwide (Amoros et al., 2019). E-commerce refers to the usage of electronic modes and technology to conduct commerce in different aspects, likewise business-to-business (B2B) and business-to-customer (B2C). It is the application of IT to facilitate business among different parties related to it (Schenkel, 2019). Nowadays, importance is also given regarding Public-Key Infrastructure (PKI), which is basically software encryption technologies and services combination (Kuak et al., 2019). It enables various enterprises through protecting the security of their communications and business transactions to a maximum extent on the internet (Rayport & Jaworski, 2001).

BACKGROUND

E-commerce has brought a universal access of the internet to the core business processes of buying and selling goods as well as services (Figueroa-Armijos & Veiga, 2019). It has helped in generating a demand for products and services along with improved order management, payment, and other support related functions (Gao et al., 2019). The overall goal is to cut expenses by reducing transaction costs and streamlining all types of processes (Awad, 2004).

Allen (2019) is of the view that those organizations which utilize Digital Enterprise Transformation can possibly attain competitive advantages to a great extent:

1. It unleashes innovation at scale and speed level as internet speed keeps on improving.
2. Customer's upcoming needs are fulfilled as they can now avail the e-portal much conveniently and can be easily aware of upcoming products as well as services.
3. Changing marketplace expectations are met by operational agility, as operational agility is a company's ability or capacity to find and seize opportunities to improve operations and processes, within a focused business model.

MAIN FOCUS OF THE CHAPTER

This research focuses on the banking perspective of e-commerce and Digital Enterprise Transformation. It also encompasses the significance and aspects related to e-commerce, e-commerce usage in developed, developing countries, and Asia, information and communication technologies, background of internet banking as well as mobile banking, and foreign remittances. Along with, financial services portal as well as bundling of information products, role of Digital Enterprise Transformation, and perceived risks in e-banking have also been discussed.

RESEARCH METHODOLOGY

The respective study is qualitative and its nature is explanatory. Secondary academic sources have been used, i.e. past researches, government reports, policy manuals, dictionaries, as well as newspapers.

BACKGROUND OF FOREIGN REMITTANCE

According to Merriam Webster Dictionary (2020), remittance is the transmittal of money (i.e. to a distant place), in accordance with Cambridge Dictionary (2020) "An amount of money that you send to someone". While, according to Collins Dictionary (2020) "A remittance is a sum of money that you send to someone".

In a general sense, it is a money transfer by a foreign worker usually to his family in their country of origin. In case of developing countries, the sent money by respective migrants also contend with international economic aid as being one of the largest financial inflows (Vezina, & Belanger, 2019; Al-Assaf & Al-Malki, 2014). With regard to labor-exporting countries, these remittances are an important component of international capital flows (Edo, 2019).

It is basically the transfer of any funds across national boundaries, or it is a transfer of money by a foreign worker to his domestic country (i.e. country of origin). Remittance itself is not a new phenomenon as human migration has ever been an integral part of the history of humans. European countries like Ireland, Italy, and Spain were very much dependent on remittances in past as received by their emigrants in the 19th and especially 20th century (Krishnamurthy, 2003). All countries developed policies regarding remittances after significant research and dedicated efforts in the desired criteria. Italy was one of the very first country to enact such laws for protecting remittances in the year 1901. On the other hand, in 1960 Spain is known as the first ever country to sign an international treaty with Argentina and this lowered the cost of the remittances received in Italy and vice versa.

Remittances play a vital role in any country's economy by contributing to economic growth as well as the livelihoods of people (Vezina, & Belanger, 2019). Remittance receivers usually have higher chances to have a bank account, and remittances also promote access for the sender and recipient regarding financial services (Chen, 2001). One of the essential dimensions of remittances is to promote and facilitate economic development (Afuah & Tucci, 2001). World Bank and the Bank for International Settlements (BIS) have developed international standards for remittance services to facilitate this in the right perspective and dimension via regulations.

BACKGROUND OF INTERNET BANKING

Technology in the modern era has forced to create new products, services, market opportunities and has facilitated in developing more information as well as system oriented business and various management processes (Pedro et al., 2018). The internet offers a variety of valuable information services that have been developed with the passage of time. These services can be electronic mail (email), file transfer protocols (FTP), and last but not the least the World Wide Web (www) itself. The internet itself has no centralized ownership, but connected networks by different, companies, authorities, universities, and other organizations are administrated and respectively owned (Hamel, 2000).

Banking is one of the most information-centric sectors, and it has an ideal path for the successful development of e-commerce as a whole (Pedro et al., 2018). Especially for banks, technology has emerged as an important strategic resource for attaining high efficiency, operational control, high productivity, and high profitability. Internet banking is helping banks as an alternative to the conventional branch banking on a macro level (Timmers, 1999). These services are necessary for long-term pace and survival

of banks in the modern world of e-Commerce. Its market is forecasted to grow sharply in the next few years undoubtedly and affecting competitive advantage as well.

Internet banking enables customers for using the internet and to access their bank accounts to process with banking transactions (Pedro et al., 2018). At the initial level, internet banking means setting up of a web page by any bank to provide information about its different products as well as services (Choi & Whinston, 1999). At advanced levels, it possess provisions of facilitation, such as accounts accessing, transfer of funds, and purchasing various financial products, and even online services. It is generally referred to as transactional online banking (Pedro et al., 2018).

The two ways to offer internet banking are:

1. A bank with its offices can establish a website, and can offer internet banking as an additional feature along with its traditional delivery multichannel.
2. Any bank can establish it as a branchless, i.e. virtual bank.

Broadly these three levels can be offered through the internet:

1. **Basic Level Services (BLS):** Uses the banks websites for customers and members of general public. It usually receives and replies customer's queries via emails.
2. **Simple Transactional Websites (STW):** They allow customers for submitting various applications, instructions, queries, etc. But, it does not permit any fund-based transactions.
3. **Fully Transactional Websites (FTW):** They allow their customers to operate fully on their accounts for the transfer of funds, different bills payment, subscription to various products of banks along with transact purchases and securities sale.

Websites play a vital role in internet banking. These websites should be able to a maximum extent to convey all information for current customers and potential new customers through the usage of the internet. The bank's website should provide a comprehensive and better communication dimension (Kolodinsky, Hogarth, & Hilgert, 2004).

The content of the site can be referred to as a 'failure' if it is unable to provide sufficient information on account capabilities. Then, one can say that the website is thus not fulfilling its true objective as required (Hamilton, 1997).

BACKGROUND OF MOBILE BANKING

1. Mobile Banking

It is a term associated with performing balance checks, account's transaction, and payments via mobile device. For more than 30 years, financial institutions have used different modes to satisfy their customers' need more conveniently. Automated teller machine (ATM) came, in New York's Chemical Bank (USA) on 2nd October, 1969 (Kirkpatrick, 2009).

Internet banking was launched in the mid-1990s, and it enabled customers to access their accounts by using a home computer with a simple internet connection. But, it faced slow as well as tentative growth as banks had to work out on technology issues and by building customer trust at instance. Mobile phones

can be carried anywhere and by majority of people. Web-enabled functions further broadened its scope. Thus, making mobile phones an ideal medium by which various services by banks can be rendered. \

2. Short Message Service (SMS)

To some extent, mobile banking and SMS banking are synonymous terms, because SMS-banking uses text (content) messaging and it works in 'push' or a 'pull' mode. As in pull mode, the bank sends one-way text for alerting a mobile user of specific account and even for promoting new bank services. While, in push mode, the mobile user sends a text via a predefined code to a specific number and the bank responds back with a text message possessing the required information (Laudon & Traver, 2001).

MOBILE BANKING IN CONTEMPORARY ERA

The idea that technology has brought a lot of knowledge, economic benefits along with the freedom to masses is now an established fact (Ford, 2019). Experience to remain in connection and exchanging information about markets as well as quick learning to change business arrangements and techniques are now making business more profitable and attractive (Huang et al., 2019). It has enabled traders towards wide markets and has eased the efforts of doing any business, and it all has a positive impact on people's life (Timmers, 1999).

With the penetration of mobiles, new economic benefits are realized by markets by using them for the purpose of banking (Pedro, 2018). There is an immense need for venturing a banking model that works on the branchless banking concept, i.e. e-banking. The extent of customer reach through the mobile banking platform is enormous. It is directly linked to the number of customers that start using the mobile phone. The mobile industry is still expanding and the telecom companies have a long way to go and sell through aggressive pricing and new package offerings (Abdou, English, & Adewunmi, 2014).

The convenience offered through mobile banking is an even bigger driver for the use of this service. The most interesting trend is that even people who are unfortunately not educated are quite capable and smart about using cell phones and readily accept new features (Zhang & Lee, 2019). This interest of the new and undaunted task of getting used to the features on the mobile phone alone would be the real force behind the take up of mobile banking across the globe (Pedro, 2018).

BACKGROUND OF E-COMMERCE

The term 'e-commerce' describes the process of buying, selling, transferring, or exchanging products as well as services and/or information by using computer networks and including the internet, electronic funds transfer (e-transfers), smart cards, as well as digital cash (like Mondex), along with all other ways of doing business over the digital networks (Turban et al., 2008).

Thus, it becomes crucial for new as well as old organizations to realize the importance of electronic commerce and to employ respective instrument for business development as well as growth (Amoros et al., 2019). Whether it is an existent or new business, either the business volume is small or large, a firm can really yield net profit via exhibiting services as well as products online (Schenkel, 2019). It results

in acquiring viewer exposure to a great extent. In brief, such actions of selling as well as buying will have more returns and profits.

Information technology industry might see it in other dimension, like as an electronic business application that is aimed at commercial transactions (Allen, 2019). Typically, it uses electronic communications technology, such as the the internet, extranet, mobile phones, databases, e-mail as well as e- books (Kuak et al., 2019). It can involve various functions, like:

1. Automated Data-Collection Systems (ADCS)
2. Automated Inventory Management Systems (AIMS)
3. E-data interchange
4. E-funds transfer
5. E-marketing
6. E-transaction processing
7. Supply Chain Management (SCM)

E-COMMERCE USAGE IN DEVELOPED VS. DEVELOPING COUNTRIES

According to Internet World Stats-2018 report, the global number of internet users continued to grow in 2018, reaching 4.2 billion people, i.e., more than 55% of the world population has an internet connection. Developing countries continue to experience faster growth in the number of internet users, because of their demographic patterns (younger populations, faster overall population growth). If current trends continue, internet users in developing countries could constitute 50% of the world total in the next five years.

E-COMMERCE USAGE IN ASIA

International Data Corporation (IDC) is an American market research, analysis, as well as an advisory firm. IDC reported in 2018 that e-commerce revenues in Asia will not come close to US or European level. The growth of e-commerce will be slower in Asia due to infrastructure, internet access, funds, different banking rules, tax structures and other issues. There is a strong interest of e-commerce in the region. But, some experts suggested that Asia should focus more to B2B (business to business) transactions. While, B2C (Business to consumer) level in Asia-Pacific region remains modest in comparison to B2B transactions.

SIGNIFICANT ASPECTS OF E-COMMERCE IN CONTEMPORARY ERA

E-commerce can be related to the respective encompassing aspects:

1. **Business process:** It is pursuing business electronically by completing business processes over the electronic networks.
2. **Collaborative framework:** It is a framework of inter and intra-organizational collaborations.

3. **Commercial (trading):** It provides the capability of buying and selling products, services, and information on the internet and also by other online services.
4. **Communication:** It is the delivery of goods, services, information, and payments by using computer networks or by any other electronic means thus available.
5. **Community:** It provides a common platform, i.e. a place for the community members to collaborate, learn, and transact.
6. **Learning:** It is an enabler of online training and education in academic institutions, like schools and universities along with other pertinent organizations.
7. **Service:** It is a tool that tries to address the desire of governments, firms, consumers, and management to cut their service costs, while improving their customer service quality as well as increasing the service delivery speed.

BANKING PERSPECTIVE OF E-COMMERCE

While conducting business operations like other organizations, banks are also taking initiatives to enhance the usage of networking technology (Rajenderan & Zawawi, 2019). However, for such organizations, the advent of e-commerce poses opportunities and questions (Kettunen & Makela, 2019). Will the role of banks in electronic commerce simply replicate their role in traditional commerce? Or will they be offering products that will modify the nature of enterprises as electronic commerce grow? And finally, risks that might emerge with the respective change in traditional business operated by banks?

The more common term as far as the banking sector is concerned is electronic-banking (e-banking) or mobile-banking (m-banking). A bank displaying a customer's balance via SMS (mobile text) is also selling information. Because, when any customer opens an account these aspects are part of the agreement the bank and customer previously agreed upon (Hawkins, 2000). The below classification is just one of many ways to categorize it. E-commerce products can be classified broadly as enlisted:

1. Foreign remittances
2. Internet banking (e-banking)
3. Mobile banking (m-banking)

BACKGROUND OF INFORMATION AND COMMUNICATION TECHNOLOGIES

According to the Free On-Line Dictionary of Computing (2020), Information and Communications Technology (ICT) is the study of technology used in handling information and facilitating communication. In 1997, Dennis Stevenson coined this phrase (ICT) in the report submitted to the government of United Kingdom. It covers the aspects already included in the wide domain of Information Technology, and further encompasses areas like, various types of video as well as audio processing and transmission, broadcast media, and telephony (Omar & Tajudeen, 2020). ICT is usually used as a synonym with information technology, but Information and Communications Technology (ICT) is more broad and encompasses additional comprehensive aspects pertinent to digital technologies as compared to information technology (Rouse, 2019).

In contemporary era, the global internet access has exceeded 4.2 billion according to Internet World Stats-2018 report. It is now offering new markets for internet-based services, like internet banking (e-banking) (Rajenderan & Zawawi, 2019). Internet is indeed a technology that spreads faster than any other technology. The usage of internet is estimated to be accelerated rapidly, and in the new millennium, e-banking has definitely experienced explosive growth in various countries.

It has also transformed traditional banking practice. As, by offering a wide range of e-banking services. Traditional financial institutions on the other hand, seek to lower their operational costs, improved consumer banking services, as well as retaining consumers, and expanding share of customers (Pedro et al., 2018).

The financial services industry proved to be one of the first to recognize the potential of the internet as a mean of interacting with consumers (Omar & Tajudeen, 2020). Unfortunately, the banks are falling behind other industries with respect to innovation within their internet channels (Pedro et al., 2018). The average user is gaining experience as well as confidence online and is increasingly going to the internet to perform tasks important to their daily lives, which includes, conducting financial transactions and seeking information about finances as well as other aspects related to it.

FINANCIAL SERVICES PORTAL AND BUNDLING OF INFORMATION PRODUCTS

By learning from how firms make use of IT, especially the internet, e-banking researchers have put forward some interesting ideas which are essentially derived from practice of e-commerce (Pedro et al., 2018; Angelache et al., 2011). In this sphere, the respective proposals can be; to create a kind of portal of financial services, and to bundle information products just like publishers bundle their electronic magazines or academic journals. Until recently, it is expensive to design a flexible investment portfolio that is tailored to the needs of individual investors (Kuak et al., 2019). Only big institutional investors can afford the fees to have securities selected especially for them. With e-commerce technology, it is possible to design and deliver the benefits of flexible and tailor-made investment in smaller accounts at much lower cost. The idea is to construct a kind of portal of financial products and services (Saatcioglu, Stallaert, & Whinston, 2001).

Another interesting idea from e-commerce is bundling (Hunag et al., 2019). Companies have been exploring the potential of using the internet technology to bundle related products to be sold to their customers as a bundle, something like package tour or one-stop shopping (Rajenderan & Zawawi, 2019). There are also examples of bundling of information products, e.g. music, electronic magazines, and journals (Altinkemer & Bandyopadhyay, 2000). Their experiences strongly suggest that banks can provide a more personalized service by creative bundling of existing financial products (Altinkemer, 2001).

The banking and financial industry is especially suited to bundling, because their products and services are essentially informational in nature and can be digitized. The more digital the product, the more easily it can be customized (Allen, 2019). For digital products, there are innumerable options for customers to choose from, Customization improves the fit between what the customer wants and what the firm can offer profitably. Moreover, with low production, distribution, and marginal costs, bundling can make sense (Bakos & Brynjolfsson, 1999). Such ideas are also very much in line with the observation of Litan and Herring (2003).

BACKGROUND OF DIGITAL ENTERPRISE TRANSFORMATION

Digital Enterprise Transformation is the incorporation of computerized technology into the domain of business. In a general sense, changing how a firm manages as well as deliver value to its consumers. In addition, it is the effect of ongoing sociocultural changes that require firms to repetitively challenge the existing parameters, experimentation, and become more comfortable with malfunctioning and even failure (The Enterprisers Project, 2020).

Stephanie Overby (2020) stated, "Ongoing digital transformation across industries became a given in 2019. At the same time, digital transformation fatigue also became very real." While, President of ISG (a global technology advisory as well as research organization), Steve Hall (2020) is of the view "2020 will still see the rapid scaling of digital initiatives across industries. In many areas, CIOs and organizations have prepped their organizations for change but haven't made the full leap to transforming their culture to fully embrace the change."

RECENT TRENDS IN DIGITAL ENTERPRISE TRANSFORMATION

According to The Enterprisers Project (2020), there exists eight essential Digital Enterprise Transformation trends that IT as well as business leadership should be aware of:

1. A shakeout (because of the investments in big data governance and analytic progression by competitors).
2. Swift adoption of digital operating models, that includes integrated cross-functional units.
3. New Digital Enterprise Transformation success metrics.
4. Ongoing acquisitions and mergers in the information technology outsourcing sector.
5. New digital partnerships should be formed by consultancies.
6. Enlargement of public cloud adoption.
7. Attention to long-term value of digital initiative.
8. Enhance use of machine learning and artificial intelligence.

SIGNIFICANCE OF ICTS IN DIGITAL ENTERPRISE TRANSFORMATION

For business organizations, progression within the domain of Information and Communication Technologies have surely provided ample opportunities, conveniences as well as cost savings (Allen 2019). These benefits are cost cutting in highly automated businesses processes, data revolution in firms which are turning data generated by Information and Communication Technologies into insights that drive new services and products, Information and Communication Technologies-enabled transactions like, telemedicine, e-shopping, and social media that facilitates its consumers to have additional selection in how they interact, communicate, and shop (Rouse, 2019).

DIGITAL TRANSFORMATION IN BANKING SECTOR

Digital transformation is basically beyond just facilitating mobile as well as online functionality (Allen 2019). Providers of traditional banking need to combine convenience along with digital speed that is compatible with human interaction (Pedro et al., 2018). It should be contemplative and protective at critical points in a consumer's journey.

While, four out of five financial organizations have a firm belief that digital transformation will essentially modify banking sector and completely transform the respective competitive landscape. According to the Boston Consulting Group 43% admit that their organization has not even formulated a digital strategy. Surprisingly, when it comes to digital transformation one-in-five executives of banking sector consider their credit union as well as organization as "market leading" (The Financial Brand, 2018).

Boston Consulting Group suggests that in order to build a digital transformation strategy, credit unions as well as banks should focus on respective pillars:

1. Leveraging the power of data
2. Reinventing a consumer's digital journey
3. Building an organization that is digitally driven
4. Redefining the existing operating model (The Financial Brand, 2018).

ROLE OF DIGITAL ENTERPRISE TRANSFORMATION IN CONTEMPORARY ERA

Digital Enterprise Transformation facilitates financial services organizations via enabling them to be more secure, compliant, as well as being digital (Allen, 2019). It modifies the experience of employees, partners, customers, and stakeholders (Schenkel, 2019). Those banks which utilize Digital Enterprise Transformation can possibly attain competitive advantages to a great extent:

1. It unleashes innovation at scale and speed level.
2. Customer's upcoming needs are fulfilled.
3. Changing marketplace expectations are met by operational agility.

RELATED ISSUES TO ICTS, E-BANKING, AND REMITTANCE

General internet usage reveals that the average user is gaining experience as well as confidence online and is increasingly using the internet to perform tasks important to daily lives (Kawai, 2019; Vondracek et al., 2019; Akhlaq, 2011). This includes conducting financial transactions and seeking information about finances (Allen, 2019; Chavan, 2013; Dannenberg & Kellner, 1998).

Allen (2019) is of the view that those organizations which utilize Digital Enterprise Transformation can possibly attain competitive advantages to a great extent:

1. It unleashes innovation at a broad scale and speed level.
2. Customer's upcoming needs are fulfilled.
3. Changing marketplace expectations are met by operational agility.

Saadullah Khan (2009) has discussed the major obstacles in low remittance, adoption issues of ICTs as well as e-banking. He has identified the respective elements:

1. Perceived (anticipated) risk
2. Registration process complexity
3. Security of the system
4. Transaction's reliability

PERCEIVED RISKS IN E-BANKING

There is a higher-level of compliance risk, because of the ever-changing technology, i.e. amount of replicated errors and other pertinent issues (Kuak et al., 2019; Khan, 2009; Florina, Liliana, & Viorica, 2008). E-banking usually fails when customers perceive its services as unreliable and slow (Pedro et al., 2018; Furst, Lang, & Nolle, 2000).

According to Yang, Whitefield, and Boehme (2007), senior citizens also face problems while using e-banking because of the lack of confidence and familiarity with it. While, Kumar, Sareen, and Barquissau (2012) stress that the level of trust is directly associated with the adoption of e-banking.

In 1962, Everett Rogers presented 'Diffusion of Innovation Theory', and it stands as one of the oldest theories regarding adoption. He stressed that an individual must comprehend the thought, behaviour, and product as well as service as being innovative. Roger also believed that only through this diffusion is possible, which acts as a key to adoption (Rogers, 2003).

Baker (1999) states that because of fraud most of the people refrain from the adoption of e-banking. While, Attaran (1999) and Kawai (2019) claims that scams are the reason behind it. In Acohido and Swartz (2008) view, cyber hackers are the real threat to customers on the internet.

SOLUTIONS AND RECOMMENDATIONS

After critically analyzing the subject matter under evaluation and going through previous researches the respective suggestions are proposed for strengthening the scope encompassing the banking perspective of e-commerce and digital enterprise transformation in contemporary era. The respective governments should invite foreign investors via engaging them in bilateral contracts and investment plans encompassing e-banking. Banks should install hardened operating systems, i.e. the system's software as well as firewalls should be configured to the highest security settings in consistency with the level of protection as per the customer's requirement. Banks should conduct regular system as well as data integrity checks. Banks also need to implement more security to minimize the associated risks as to increase their customer's authentication, such as personal identification number and audit trial for transactions. Customers who are not be technologically sophisticated should be appealed by banks, as services should be simple enough to use. Private banks should develop a strong liaison with the respective government regarding the swiftness of their internet approach. More customized and featured mobile banking services should be introduced.

FUTURE RESEARCH DIRECTIONS

Significant areas for conducting future research encompassing banking perspective of e-commerce via engaging qualitative, qualitative, or eclectic approach can be, identification of e-banking related issues, issues in e-commerce sector, cyber security issues in e-commerce, gender adaptability of technology, perceived and actual risks in e-commerce, ease of doing business and the dilemma of cybercrime, foreign investments in ICT sector and its effect on cyber behavior, identification of ICTs related issues and e-fraud, issues encompassing online crimes and role of remittances in contemporary era.

CONCLUSION

Every country in this contemporary era has to implement e-commerce services and products because of the competitive nature of global economy. Invasion of the banking sector by this technological aspect has created and effected an information age as well as a commoditization of these banking services respectively. Digital Enterprise Transformation facilitates financial services organizations via enabling them to be more secure, compliant, as well as being digital. It modifies the experience of employees, partners, customers, and stakeholders. Now, banks have realized that for survival in new economic scenario delivering few or most of their banking services via mobile technology or internet is imperative. With the rise of e-commerce, the aspects in banking have redefined business relationships altogether. Successful banks will be those which can truly strengthen their relationship with their customers.

Fierce competition among existing banks and technological innovation have truly enabled a wide range of banking services and products. All this is available for retail and wholesale customers via a channel of electronic distribution, and is generally termed as e-banking. Now the banks are in the forefront to improve product and efficiency via harnessing technology. Technology itself is modifying relationships among banks along with its internal as well as external customers. With the advent of technology, barriers faced by many industries have been removed. Technology has brought superior products and channel's management with specialized focus on customer relationship in its true sense. The reason for rapid growth of internet and mobile banking is basically its acceptance as being an extremely cost-efficient delivery channel and access to accounts from anytime and anywhere thus required.

Remittances contribution in economic development has been throughout as it has assisted for reviving economic activities; creating employment opportunities, reducing poverty, improving living standards of the recipient's family, and also prevented balance of payment (BOP) critical issue. It has also supported in building foreign exchange reserves, and provided exchange rate stability, thus improving the country's credit rating.

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KEY TERMS AND DEFINITIONS

Banking: The services offered by a bank.

Digital Enterprise Transformation: Strategies by which organizations take advantage of information technology to develop digital capabilities.

E-Banking: Online banking (i.e., via the internet).

E-Commerce: Transactions conducted on the internet.

Enterprise: A business or company.

ICTs: Technologies that provide access to information through telecommunications.

Perceived Risks: Uncertainty a consumer has while using electronic services.

Remittance: A transfer of funds by an expatriate to his country of origin.

Strategy: A plan of action designed to achieve a long-term or overall aim.

Telecommunications: It is the exchange of information over significant distances by electronic means.

Transformation: A marked change in form, nature, or appearance. over significant distances by electronic means.

Chapter 14
The Impact of Digital Enterprise Transformation Strategies on Project Managers' Competencies

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ABSTRACT

Faced with the increasing number of challenges that came with globalization, the developed countries have become aware of the insufficiency of traditional production systems and increased investments in technological developments in the production sector. With successive technological developments, the competition in the production sector has increased, and businesses have had to undergo major changes. It was aimed with these changes to respond quickly to dynamic market conditions and customer demands. The project, which was firstly introduced by Germany as Industry 4.0, affects enterprises both technically and socially. Employees have to adapt to digitalized production systems and keep up with technological developments. In a world where inter-business and inter-disciplinary studies and collaborations increase and operations are carried out on a project basis, project managers are obliged to adapt quickly to the continuing digital transformation. In this context, the chapter aimed to identify the impact of digital transformation on project managers' competencies.

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INTRODUCTION

Production is extremely significant for all countries to generate economic profits. In recent years, the rapid aging of the population in European countries together with the increase in competition with other developed countries, led to the need to reduce the workforce and development of industrial technologies (Qin et al., 2016). The new challenges faced during this period have left the traditional production industry inadequate, and as a result, intelligent production systems have been developed to deal with the problems associated with globalization (Hecklau et al., 2016).

The decrease in the cost of sensors, data acquisition systems and computer networks, and consequently, the notable increase in the usability of these technologies shaped by the developments experienced, forces all enterprises to undergo substantial technological changes (Lee et al., 2015). The rapid developments experienced in electrics, electronics, informatics and advanced production technologies has enabled the production to become smarter, and the global industry has changed considerably due to the successful innovations and technological developments. At this point, dynamic market conditions, rapid advancement of technology and low-cost labor in underdeveloped countries spurred the developed countries into action, whose economies are largely dependent on the production sector. As one of the developed countries mentioned above, Germany has attached importance to the studies in this direction, and proposed "Industry 4.0 (I4.0)" concept and announced their strategy to execute this concept. This act was followed by China with "Made in China 2025", by Japan with "Intelligent Manufacturing Systems (IMS2020)", by United Kingdom with "Manufacturing 2050" and by United States with "Smart Manufacturing Leadership Coalition" (Chen et al., 2017; Zhong et al., 2017).

With the fourth industrial revolution (4IR), the number of projects carried out to establish new companies and to develop, implement and maintain new technologies, products, or services is increasing. These I4.0 projects are characterized by high complexity and great uncertainty associated with the structural, organizational, socio-political, etc. issues, as well as new technologies, such as, the Internet of Things (IoT) (Pajares et al., 2017). Traditional project management (PM) approach, which emphasizes planning and control and does not focus on the human factor and soft skills adequately, starts to lose its validity in I4.0 projects, in which the complexity, uncertainty and time pressure is high.

The management practices and approaches that have been proposed and applied till now, will not be compatible with I4.0 conditions (Shamim et al., 2017). The flexibility expected from employees will increase and competencies such as self-management and PM will be vital (Störmer et al., 2014). During this period, competencies that have not been mentioned so far will come into prominence with the 4IR. In line with all the developments that have occurred so far and will occur in the near future, this study aims to reveal the impact of digital transformation (DT) on project managers' competencies by analyzing the existing PM and I4.0 literature and answering the main research question "Which competencies the project managers will need to have in the DT era?".

Firstly, after a brief introduction to the study, the definition and content of traditional PM, the responsibilities and competencies of project managers are presented in Section 2. Then the I4.0 concept, implementation difficulties, and application examples are discussed in Section 3. Thirdly, within the scope of this study, the competencies compiled from the traditional and up-to-date PM literature are listed and evaluations are made regarding the impact of DT on project manager competencies in Section 4. Finally, Section 5 summarizes the conclusions of this study. By doing this study, it is aimed to guide project managers, who will play an important role in the transformation process, in defining competencies that will be essential to manage all types of future projects successfully.

THE RESPONSIBILITIES AND COMPETENCIES OF PROJECT MANAGERS

Today, almost 25% of global economic activities are carried out with projects (World Bank, 2012; cited by Bredillet et al., 2015). Particularly, the enterprises with high information intensity become project-based in order to adapt quickly to the changing market conditions. As the number of projects increases, the failure rates of the relevant projects increases, and therefore, the need for project managers that have the skills critically required for managing the projects effectively, increases.

PM involves determining the necessity of the project; assessing the feasibility of the project; meeting project requirements; identifying the quality of project deliverables; calculating resource and time requirements; ensuring a complete corporate consensus and adequate financing; leading and motivating the project team; managing risks, problems and changes in the project; monitoring project progress; managing project budget; communicating with internal/external stakeholders; managing suppliers and finally terminating the project in a controlled manner (Nicholas & Steyn, 2012).

In this context, PM is a very comprehensive activity and requires differing professional competencies. Standards, such as, the Project Management Body of Knowledge (PMBOK) published by the Project Management Institute (PMI) have influenced the understanding and implementation of the PM concept. In the literature, project managers are expressed as heroes who carry ultimate responsibility for the projects. Bredillet et al. (2015) defines a successful project manager as "the one who: possesses some attributes to fulfill her/his role; and will demonstrate a certain level of performance".

There is no consensus in the literature on what skills and features project managers should have. This situation stems from the fact that 'each project is unique with its own specific goals that must be achieved', which is one of the properties distinguishing the projects from other type of works.

Project managers are responsible for the project, organization, team, and themselves. Therefore, it is the responsibility of project managers to ensure a proactive information flow within the organization through calculations, regular status notifications and forecasts; smooth and efficient progress of the handled projects; and ensuring the contribution of these projects to organizational goals and success. Project managers have to inform team members throughout the project, be aware of their performance, and provide constructive feedback too them, while fulfilling their own responsibilities.

Project managers must have full knowledge of PM tools and techniques (e.g., network diagrams, Gantt charts, work breakdown structures, progress curves, etc.) and process technologies, as well as competencies like 'leadership', 'communication', 'conflict management', 'empowerment' and 'coaching'. Additionally, they must be proficient in technologies that form the basis of the relevant projects; must have knowledge about the industry, products, and processes; and must manage the use of technologies. Project managers need to approach events and things from an holistic perspective and have high tolerance to uncertainty (Heerkens, 2014). Managing conflict, facilitating change and function as a bridge between those involved in the project are also among the responsibilities of project managers (Wateridge, 1997; Clarke, 1999; Stevenson & Starkweather, 2010).

Different organizational cultures may require giving importance to different competency areas for the projects carried out (Udo & Koppensteiner, 2004). What distinguishes successful project managers from others is that they spend more time in planning, communicate more effectively and act with higher authority (O'Brochta, 2008; Stevenson & Starkweather, 2010). According to the literature, competencies such as 'managing emotions', 'building trust', 'effective communication', 'inclusiveness and diversity', 'team building', 'leading', 'motivating and influencing others' are among the competencies required for successful PM.

Krahn & Hartment (2006) stated that the priorities of the project manager skills and competencies change as the characteristics of the projects (e.g., scope, uncertainty, novelty, …) changes; the skills and competencies that project managers and project sponsors attach importance differ; as environmental uncertainty, complexity and volatility increases more leadership is needed rather than management; and the skills related to PM and project leadership become effective only when they are used together in accordance with the needs of the project.

RESEARCH METHODOLOGY

Organizations that change both technically and socially due to DT, have to change their project managers both technically and socially as well. Studies in the PM literature support this change from different perspectives. The results of the studies exploring the effects of the I4.0 concept on organizations have differences as well as similarities. When the competencies specified within these studies are compared and matched with some of the well-known competency models in the literature, these differences become obvious.

In this context, project manager competencies that are emphasized in the examined studies are compared and matched with the competencies identified in four of the well-known competency models in the literature: (i)Harvard competency model, (ii)McBer competency model, (iii)Rothwell and Dubois competency model and (iv)Wyoming competency model. These models contain behavioral competencies that are widely used in enterprises and form the basis for most of the human resources applications such as recruitment, performance appraisal, training, development, career planning, etc. (See Table 1).

As the same behavioral competencies can be expressed in different ways by different researchers and as the same expression can stand for different competencies, instead of directly using the relevant competencies mentioned in the examined studies, these competencies were compared and matched with the ones in the reference competency models. Therefore, in this study, based on the definitions and scopes of the competencies pointed out in the literature, it was determined which competence they corresponded to in the above mentioned competency models and evaluations were made based on these determined competencies (See Table 2; Karal (2019) for details). In this way, differently from the studies used in this study, the competencies required for project managers in the DT era are summarized according to the well-known competency models in the literature and a holistic view is provided.

BACKGROUND: INDUSTRY 4.0 AND DIGITAL TRANSFORMATION

The Concept of Industry 4.0

I4.0 is "a new level of value chain organization and management across the lifecycle of products" (Kagermann et al., 2013; cited by Lu, 2017). Increasing efficiency forms the basis of all industrial revolutions. I4.0 contributes to this increase through new technological developments that form smart factories. In I4.0, production consists of machinery, equipment and production units that act autonomously and intelligently and exchange of information among themselves (Qin et al., 2016), and there are three main themes related to it: (i)'dealing with complexity', (ii)'building capacity for innovation', (iii)'providing flexibility' (Bauernhansl et al., 2014; cited by Mrugalska & Wyrwicka, 2017).

Table 1. Behavioral competencies included in competency models

Competency Model	Behavioral Competencies
Harvard Competency Model (Harvard University, 2011)	Adaptability; Success Orientation; Applied Learning; Team Building; Building Customer Loyalty; Building Partnerships; Teamwork/Collaboration; Building Trust; Coaching; Communication; Continuous Learning; Contributing to Team Success; Customer Orientation; Decision Making; Delegation; Development Management; Energy; Change Management; Follow-Up; Formal Presentation; Gaining Commitment; Influencing; Knowledge Management; Initiative; Innovativeness; Leadership; Conflict Management; Work/Time Management; Meeting Leadership; Meeting Participation; Negotiation; Planning and Organizing; Quality Orientation; Risk Taking; Safety Awareness; Persuasiveness; Strategic Decision Making; Stress Tolerance; Technical/Professional Knowledge and Skills; Tenacity; Multicultural Approach; Results Orientation
McBer Competency Model (John Raven, 2001)	Success Orientation; Analytical Thinking; Conceptual Thinking; Customer Orientation; Development Management; Directiveness; Flexibility; Influencing; Knowledge Management; Initiative; Integrity; Interpersonal Understanding; Organizational Awareness; Organizational Commitment; Relationship Building; Self-Confidence; Leadership; Teamwork/Collaboration
Rothwell & Dubois Competency Model (Dubois & Rothwell, 2000)	Conflict Management; Creative Thinking; Customer Orientation; Decisiveness; Evaluation; External Awareness; Financial Management and Responsibility; Flexibility; HRM: Performance Management; HRM: Enhancing the Quality of Work Life; HRM: Staffing, Recruitment, Selection, and Assignment; Influencing; Interpersonal Understanding; Leadership; Management Control; Multicultural Approach; Oral Communication; Planning; Problem Solving; Self-Management; Team Building; Technical/ Professional Knowledge and Skills; Technology Management; Vision; Written Communication
Wyoming Competency Model (Wyoming Workforce Planning, n.d.)	Influencing; Building Strong Alliances; Teamwork/Collaboration; Decisiveness; Due Diligence; Influencing; Internal/External Institutional Awareness; Vision; Financial Management and Responsibility; Change Management; Coaching, Counseling and Mentoring; Conflict Management; Development Management; Multicultural Approach; Human Resource Management; Motivation; Program/Project Management; Strategic Planning and Evaluation; Team Building; Building Consensus and Negotiation; Knowledge Management; Customer Orientation; Flexibility; Networking; Resource Management; Responsiveness and Follow-up; Tact and Diplomacy; Teamwork/Cooperation; Learning; Mathematical Reasoning; Basic Computer Skills; Analytical Thinking ; Listening; Problem Solving; Reading/Reading Comprehension; Reasoning; Verbal Communication; Written Communication; Dependability/Reliability; Results Orientation; Integrity/Honesty/Ethics; Interpersonal Understanding; Responsibility, Personal Accountability and Ownership; Stress Tolerance; Willingness to Learn

I4.0 is based on the notion of meeting the individual needs and demands of the customers. Individualization is an important aspect that triggers I4.0. Today, most of the customers demand more quickly and easily purchased personalized products. The products that can determine its own route in production can be unique, and by this way customization can be achieved (Tjahjono et al., 2017). Mass customization concept combines the individuality and precision of single piece production, and the speed and affordability of mass production (Zawadzki & Żywicki, 2016).

Digitalization, which has a critical role at this point, can only be possible by the development of information and communication technologies (ICT). With digitalization, significant improvements are experienced in design and production processes, functions of the produced products, and production systems as a whole. The digitalization of all products, processes and resources in the value chain and their connection with smart networks, provide agility and flexibility to businesses (Pîrvu & Zamfirescu, 2017). The ability of a production system to perform different tasks and the speed of set up to perform new tasks are measures used to indicate the relevant system's flexibility. By means of I4.0, technologies, products, machines and processes can easily adapt to the current changes in the environment, and therefore, all systems become more flexible and self-controllable (Hecklau et al., 2016).

The I4.0 concept involves a smart factory where smart processes and products are being created through the use of smart machines (Pereira & Romero, 2017). Smart factories utilize modern ICT to en-

able human beings, machines, products and resources to exchange information (Wagner et al., 2017) and connects human, machine and data. At the heart of smart factory, which is a network of cyber physical systems, lies flexibility, self-adaptability, learning, fault-tolerance and risk management (Bunse et al., n.d.). What gives a smart factory the flexibility of creating a wide range of products is having a reconfigurable production line that is changeable, scalable and programmable; and through this production line, a smart factory can quickly respond to the changing market needs (Chen et al., 2017).

Table 2. Project manager competencies from the literature

Project Manager Competencies From the Literature* Matched With the Ones Included in the Competency Models			
Analytical Thinking	Financial Management and Responsibility	Integrity	Problem Solving
Knowledge Management	Development Management	Leadership	Strategic Thinking
Information Technologies	Initiative	Customer Orientation	Stress Tolerance
Environmental Consciousness	Empowerment	Motivation	Data Analytics
Multicultural Approach	Communication	Self-Management	Efficiency Orientation
Change Management	Human Management	Project Management	Technology Management
Digital Transformation	Work Management	Risk Management	Innovativeness
Flexibility	Teamwork/Collaboration	Systematic Approach	
Planning and Organizing	Decision Making	Results Orientation	
Influencing	Resource Management	Responsibility, Personal Accountability and Ownership	

* (Abraham et al., 2001; Murch, 2001; Cheng et al., 2005; Brill et al., 2006; Stevenson & Starkweather, 2010; Fisher, 2011; Sumner & Powell, 2013; Trivellas & Drimoussis, 2013; Keil et al., 2013; Zulch, 2014; Heerkens, 2014; Bredillet et al., 2015; Montequin et al., 2015; International Project Management Association (IPMA), 2015; Pajares et al., 2017; Pinzone et al., 2017; Grzybowska & Lupicka, 2017; Ko & Kirsch, 2017; Kravcik et al., 2018; Wahlund & Wahlberg, 2018)

Automation of some tasks performed by operational employees is already common in many sectors in the industry; but in the course of time, the focus has been shifted from physical activities to mental activities. Technologies that come with I4.0 perform repetitive physical tasks, and leave only more complex mental tasks to human beings (Gentner, 2016). In essence, I4.0 promotes the use of brainpower rather than physical-power.

In the I4.0 concept, computers and automation come together in a new and different way, and the human contribution required in this integration is very low. The technologies brought to the workplace sometimes produce incremental effects that change processes, transform the work or sometimes even transform the whole organization (Baptista et al., 2020). But Benešová & Tupa (2017) claim that the human factor will become more important in the future of production, as because, the coordination between humans and robots in smart factories significantly affects production efficiency (Lee et al., 2018).

Difficulties and Challenges of Industry 4.0

The fact that the concept of I4.0 is not yet fully understood causes problems at the application stage. The researchers, consultants, and practitioners have different definitions about the concept and this situation

leads to uncertainty and confusion about I4.0 and prevents consensus. While the research on this subject continues, new requirements, new areas, and new difficulties are encountered. But it is also stated that it is not the perception of I4.0 barriers that prevents the application of I4.0 technologies, but rather the managers' lack of comprehending I4.0 drivers (Stentoft et al., 2020).

Schumacher et al. (2016) listed the key challenges faced by enterprises while implementing I4.0 as (i)the concepts constituting I4.0 being too complex, (ii)the idea of I4.0 and its offerings being not clearly understood, and (iii)the relevant enterprises not being able to evaluate their capabilities emerging from I4.0. On the other hand, Kagermann et al., (2013), explained three major difficulties of I4.0 implementation as (i)standardization, (ii)process/work organization and (iii)product availability.

The fact that I4.0 affects the supply chain as a whole causes business models to be significantly affected (Pereira & Romero, 2017) and new applications introduced by cyber-physical systems force existing business and market models to change (Bunse et al., n.d.). Enterprises that obtain, utilize or transform external data, are able to engage in innovation strategies and consequently in new business models (Müller et al., 2020). But enterprises not being able to adapt their business strategies to I4.0, and not being able to follow the steps needed to be taken and changes needed to be made in the implementation phase, creates the need for new methods and tools.

In today's highly competitive market conditions, enterprises should produce more customized products, which are adaptable and can be altered in real time, and offer competitive prices as well. Although mass customization is highly attractive from a customer's point of view, it creates a great challenge for enterprises as it increases design and manufacturing costs, and as the diversity of variants of products makes scheduling and production control more costly and difficult (Zawadzki & Żywicki, 2016).

Today's technologies are not yet sufficient to realize the smart factory concept fully. Practical methods and major technologies that enable the collaboration of production and automation engineering fields are not widely used. The lack of flexible and configurable structure of current manufacturing equipment complicates the adaptation to environmental changes (Chen et al., 2017).

Since there will be much more data available due to the extensive use of IoT enabled technologies in the recent era, the need for advanced information technology infrastructure, the need for standardization to enable integration, and the need for an effective knowledge base to cope with environmental uncertainty increases. Existing industrial networks will not be sufficient for intensive communication realized in smart factories (Wang et al., 2016).

Particularly production planning and control employees will face a considerable amount of big data generated by cyber physical systems (Prinz et al., 2016). As new sources of data continue to grow in volume, variety and velocity, so does the management of these big data, which includes data mining, classification and storage (Lu, 2017). The intense data exchange that comes with digitalization will pose a great danger for I4.0, if safety and security of ICT has not been established. Automation is getting more complex as new technologies that form the basis of I4.0 concept reveal autonomous components that are in continuous communication with networks of applications (Fantini et al., 2020).

On one side, increasing productivity and new business models will create value for organizations, but on the other side, the organizations that cannot gain the ability of 'digitally thinking' will fall behind competition (Roblek et al., 2016). Problems related to the legality of new technologies and data protection issues can slow down innovations, and short technological innovation cycles together with the disruptive nature of new technologies can lead to an implementation gap (Kagermann et al., 2013). With I4.0, machines and computers will be able to perform routine and repetitive tasks done by low skilled

labor, and even, highly skilled and educated employees will also be threatened by new and emerging technologies (Ford, 2009; Bonekamp & Sure, 2015).

As faster mobile internet access became more common and started to be used in all areas of business life and IoT became a reality, all employees from all levels and from all sectors have to specialize in technology. Relatively older employees will also need to have comprehensive knowledge of technology and technological developments in order to compete in the labor market.

Organizations will be in need of creative and innovative employees both at the managerial and operational levels (Shamim et al., 2017). As skills and competencies sought in new employees change, there will be difficulties in the training and recruitment stages of new workforce. Since behavioral competencies such as 'decision-making', 'problem-solving', 'creativity' and 'social behavior' are assessed by individual activities, and different skills and characteristics of employees have to be taken into account along with the different properties and objectives of cyber physical systems, there will be difficulties encountered in work design and evaluation (Fantini et al., 2020).

SOLUTIONS AND RECOMMENDATIONS

The catalyst that causes DT to occur is the rapid and radical developments in technology. Because of these developments, project managers began to manage projects in different types of organizations in which advanced technologies are widely utilized. This causes a change in the competencies that will be needed for the project managers to fulfill their responsibilities.

The current literature on PM in the context of 4IR, explores the competencies required by project managers in this dynamic environmental context. For example, Pajares et al. (2017) offer new methodologies for managing projects with different characteristics and projects carried out in different environments. According to Pajares et al. (2017):

- New technological projects will require the integration of PM and innovation management.
- It would be beneficial to develop and adopt the 'agile' approach, in which the project team cooperates with customers and other stakeholders continuously.
- The new competencies of the project manager will be focused on complexity and innovation.
- Project managers need to be more business-oriented and focus on concepts such as economic value, strategic value, and urgency rather than scope, cost, and time.
- Project managers will need trust and cooperation competencies within distributed networks, where they can take part both as an actor and as a leader.
- Due to the shortening product life cycles, the project manager and project team should be capable of working under time pressure.
- As the focus of PM is now on the market success of the products/services, while it was on achieving a physical deliverable in traditional PM, project managers should focus on market success or value proposition rather than physical outputs.
- As organizations with different core competencies will need to collaborate in a more open and innovative environment due to high technological complexity in I4.0 projects, project managers will need to develop skills that enable them to work in this collaborative environment.

- New projects will be carried out within a startup thinking approach in which the final products (or services) are produced iteratively according to the market requirements. Therefore, project managers should align their management styles with this lean startup approach.

Wahlund & Wahlberg (2018) indicated that 'analytics', 'business model', 'security and privacy', 'willingness to change', 'creativity' and 'relationship management' competencies will gain importance with digitalization. Grzybowska & Lupicka (2017) stated that the challenges of I4.0 can be overcome with 'creativity', 'entrepreneurial thinking', 'problem-solving', 'conflict-management', 'decision-making', 'analytical-thinking', 'research' and 'efficiency orientation' competencies and added that the importance of these competencies may differ from one sector to another.

When the studies are divided into two groups as studies that examine the project manager competencies before and after digitalization, it becomes clear that some competencies' importance increases with DT and some new competencies appear to emerge with I4.0 (see Table 3).

DT, which has become an imperative for organizations in the context of rapid technological developments, has both technical and behavioral aspects. From technical point of view, DT can only be realized by the leveraging innovative technologies (e.g., IoT, big data, cloud, robots, simulation, augmented reality, etc.) where needed. At this point, before starting this transformation process, its related steps should be determined firstly, and then a roadmap should be drawn. In this stage, which can be considered as a 'transition to I4.0 project', it is extremely important for project managers to play an active role and take on leadership. The successful application of the relevant new technologies is only possible if resources are efficiently used and if project managers guide the strategic decisions.

Eller et al. (2020) stated that along with IT and employee skills; digital strategy has a positive effect on digitalization. The digital strategy of an enterprise has to include the renewing and redesigning of the business model to align with the market needs. 'How and whom to serve', 'how to exploit the available resources and technologies'; 'when, how and with whom to cooperate with' are some of the questions that need to be answered by taking the new market conditions into account. During this transformation process, possible opportunities and challenges to be encountered should be evaluated along with the financial indicators (e.g., ROI (Return on Investment), ROA (Return on Assets), etc.). Therefore, one of the key competencies that the project managers should have is the 'entrepreneurial approach'. Project managers should take initiative for change should not avoid taking responsibility.

The changing business models necessitate universal networks that connect all departments within an organization, and even connect different organizations; because the successful application of the information technology structures and platforms for I4.0 will only be possible with the establishment of these digital networks. All robots, machines, products, and human beings in the organization will be a part of these digital networks. The establishment of such digital networks implies a need for high standardization (Kagermann et al., 2013) and for project managers who are competent in the design, installation and use of them (Pinzone et al., 2017).

Widespread use of IoT and artificial intelligence in various industries will have an impact on PM, and thus project managers to a great extent. Project managers will be constantly exposed to the status notifications coming from a large number of devices and will take part in the IoT projects. With artificial intelligence, project managers will be sure about safety and continuity issues and some of the responsibilities of project managers, such as, matching team members to tasks, performance appraisals, report preparation, etc., will be carried out automatically (Burger, 2017a, 2017b). Artificial intelligence will be able to provide actionable insights and suggestions regarding daily operations, take on all repetitive and

tedious tasks, simplify and improve PM processes, and eventually, project team members will have the chance to focus on tasks that require 'creativity' and 'innovation' (The Evolution Of Project Management - Trends For 2018, 2017). Selection of project team members, reduction of idle times by assigning tasks to team members according to their workloads, keeping know-how in the organization in case of staff mobility, anticipating dangers before they occur and taking necessary precautions are among the examples that artificial intelligence can contribute to PM (Burger, 2017a).

Wearable devices will provide project managers with physical and emotional data of the team members and with information about the products manufactured, services being provided, changes required to provide suitable work environments, etc. (The Evolution Of Project Management - Trends For 2018, 2017). In the facilities where I4.0 technologies will be used, project managers will not only be in communication with human beings, but also with collaborative robots. Monitoring and control of robots will be done remotely with the help of sensors, tablets and similar digital devices and augmented reality technology will be used for the maintenance of these devices (Pinzone et al., 2017). Workplace optimization and product tracking can be visualized with the help of indoor location detection and object identification technologies (Lee et al., 2017) and real-time management will be possible with the use of new advanced monitoring and tracking technologies. As a result, project managers will be able to manage human beings and machines continuously.

As digital twins can communicate with the physical systems they represent via real-time sensing devices, simulations that are synchronized with the real-time status of the relevant systems can be carried out. This situation necessitates learning how to use modeling tools to perform these simulations. According to Wagner et al. (2017) human-machine interaction will be possible through augmented reality, which facilitates information sharing between human beings and machines. Therefore, it can reasonably be foreseen that, people and machines will work more closely and collaboratively in the near future, and accordingly, the selection, specification, and integration of advanced human-computer interfaces are among the topics that project managers have to be competent in (Pinzone et al., 2017).

With the use of I4.0 technologies, the quantity and diversity of big data is exploding day by day. Therefore, management of the data that will be continuously generated by the devices that are part of a digital network becomes an important issue. The first two things that need to be considered in this regard are the selection and implementation of data communication protocols and the design of data flow models. Project managers will have to learn how to analyze big data coming from various devices and sensors, develop and use applications and tools for big data analytics, and use cloud computing and data storage (Pinzone et al., 2017). The 'data analytics' competence, which can be defined as a competence that enables a project manager to fulfill all responsibilities related to big data management, will be of great importance for managing the projects in which huge amounts of data will have to be used.

Table 3. The essential project manager competencies for DT

Competencies That Became More Important in Digital Era	New Competencies That Emerged in Digital Era
Multicultural Approach	Digital Transformation
Change Management	Data Analytics
Flexibility	
Development Management	
Initiative	
Customer Orientation	
Innovativeness	

By creating a virtual copy of the physical environment in smart factories, real-time and useful information becomes available, and this information strengthens organizations' ability to make better decisions. In line with these kind of developments, efficiency in the transfer, gathering, development, and management of the information is ensured (Lu, 2017), and correspondingly, the decision making process becomes easier through data analysis. Continuous data flow and continuous manufacturing becomes possible with the increasing data storage capacities. Under these conditions, the effective management of big data requires being competent in big data analytics (Wang et al., 2016). At this point, 'cybersecurity' becomes an important issue to be considered. In order to provide permanent solutions for issues such as management of personal data, the organizations are being urged to cooperate with cybersecurity companies (Rüßmann et al., 2015). Besides cybersecurity, physical security is also another issue that must be considered.

I4.0 brings about social changes as well as technological ones. As most of the projects contain social aspects, not merely the technical, it is among the responsibilities of the project managers to realize the technological transformation within the scope of digitalization process, and transforming the human factor within the system as well. While 'change management' has been one of the most important competencies in organizational life, I4.0 refers to a much more comprehensive and fundamental change for organizations. While functional activities have undergone minor changes or improvements over time, developing new technologies and emerging forms of doing business endanger the survival of organizations. For this reason, the primary task of project managers during the management of change is to support the change. The transformation will only be possible with employees who believe that change is possible and who are ready to strive for change.

The level of human involvement in the production activity decreases over time and the tasks performed at the operational level turned out to be more managerial in nature (Neugebauer et al., 2016). New professions are emerging in the field of ICT (Bonekamp & Sure, 2015) and it is believed that the number of employees will decrease due to the transformation experienced (Stock & Seliger, 2016). During this transformation, the task profiles and working environments of the current employees also change. All these changes force project managers to look for new methods and approaches to evaluate project team members and require specific attention to be given to the new social infrastructure (Kagermann et al., 2013).

Trying to adapt to the changes that organizations are going through, cause difficulties to project team members in very different ways. Skills, practices, and techniques that are acquired in advance will be

insufficient in smart factories that have implemented I4.0 principles. The fact that robots can take part in manufacturing and perform repetitive processes will give employees a chance to improve themselves.

With the identification of deficiencies and shortcomings in the workplace, creating an ecosystem where employees can improve themselves, learn continuously, and practice what they have learned seems to be one of the biggest needs. With the emergence of new professions, the demand for job-based training will increase and online training with low cost will be preferred (Störmer et al., 2014). 'Managing the development of project team members' will be one of the important responsibilities of the project manager. Therefore, it will be necessary to apply new tools and methods, such as, artificial intelligence, augmented reality, etc. to improve the skills of team members.

In order to avoid the negative consequences of the realized change, current standards should be adapted to specific organizations and 'change management' capacities of employees should be assessed properly (International Project Management Association (IPMA), 2015). At this point, 'flexibility' competence is a critical competence that will help project managers in adapting standards and dealing with the increasing uncertainty of projects. In I4.0 literature, flexibility is defined as a feature that production lines should have to adapt quickly to fulfill customers' dynamic requirements. Correspondingly, project managers should be able to adapt quickly to all kinds of changes and unexpected events; in other words, they should develop the desired flexibility competence.

Cyber physical systems that make up smart factories become self-organizing (Weyer et al., 2015; C. K. M. Lee et al., 2017), can make decentralized decisions (Lin et al., 2017), and gain autonomy (Bunse et al., n.d.; Hermann et al., 2016). Hence, the traditional hierarchical structure appears to lose its importance (Störmer et al., 2014). As employees will be taking part in various projects simultaneously and number of virtual collaborations that will occur in projects will increase, the importance of 'cross-functional management' ability (Bonekamp & Sure, 2015) and 'flexibility' as a competence of project managers will also increase.

As a result of DT process, organizations in the production sector will have to increase their innovation capacity, and in this context, applications such as the usage of digital platforms in innovation process will gain importance (Störmer et al., 2014). The use of new technologies in new manufacturing facilities will force employees to approach existing business processes from a different perspective, to discover new methods, and to adopt new approaches. I4.0 will provide both time and opportunity for employees to push their limits and think outside the box. In this context, employees will be able to conduct innovative research instead of just doing work that only requires physical strength. To support the team members' progress in this direction, project managers will need to be 'creative' and adopt an 'innovative approach'; and it will also be important to track technological trends (Chen, 2017).

Today's customers are much more conscious than ever before, and they take more active role in production processes through the new supply chain structures. New type of customers, who have strict rules regarding the functions and appearances of products that they buy, force organizations to update their business models and want to have a say in every stage of the manufacturing process. I4.0 gives customers the chance to be involved in the production chain (Stock & Seliger, 2016) and forces organizations to provide customized products. In order to enable efficient customization, user-friendly designs in which customer requirements can be easily received in full detail, must be considered and constructed. Modularization of products is an example of these kind of designs (Jazdi, 2014; Pereira & Romero, 2017). Likewise, after sales channels offering continuous customer support have to be set up and kept active all the time. Therefore, one of the essential competences of project managers is to adopt

a 'customer oriented' approach that aims to meet the demands of customers, and thus, to function as a bridge between the customer and the organization.

Today, many organizations have a multinational structure, and that is why, 'multicultural approach' is also considered as one of the important competences that project managers should have. While managing project teams, which can have a multinational structure, performing the task of harmonizing different values and cultures falls to the project managers (International Project Management Association (IPMA), 2015). However, the universal networks emerging with I4.0 will expand the size of tasks that can be done collaboratively and increase the level of cooperation between the companies located in different regions. Multinational project teams, including employees from different sectors, will be established by organizations that aim to create new values. Project managers will need to manage project teams of this structure by applying a 'multicultural approach' and by methods that enable remote working and collaboration.

Störmer et al. (2014), foresee that the future works will be carried out on a project basis. During this process, the upcoming changes, such as, reduction of workload through artificial intelligence, mobile imaging and software systems; reduction of waste through additive production technologies like 3D printers; improvement of decision making and proactive decisions that can be achieved through big data analytics and end-to-end transparency (Kagermann et al., 2013; Chen, 2017), will allow the optimization of the project outputs. However, this will increase and complicate the responsibilities of the project managers regarding 'human management'. The management of multi-generational workforce and the need to establish a work-private life balance will cause challenges for project managers in managing project group dynamics. Additionally, the need for a continuous communication between suppliers, manufacturers and customers, will also require project managers to be competent in different forms of communication.

I4.0 presents a picture with high costs (Jäger et al., 2016), high organizational complexity (Stock & Seliger, 2016) and limited resources (World Economic Forum (WEF), 2016) for existing organizations. While the scale of the organizations determines the scope and size of the difficulties that will be encountered during this process (Kagermann et al., 2013; Schumacher et al., 2016; Müller et al., 2018), there also exist various problems in implementation due to the fact that I4.0 is not fully understood (Hermann et al., 2016). In order to overcome these problems encountered during the implementation phase and take solution-oriented steps, it will be critical for project managers to have 'problem solving' competence (World Economic Forum (WEF), 2016).

Along with social and economic developments, technological developments are also continuing. As the scope of ICT expands with technological developments, systems become more smart, intelligent, and fast. Systems with the ability to act quickly will need to be managed quickly in the same way. Therefore, in I4.0 conditions, where the majority of jobs will be project-based, it will be beneficial for project managers to act 'quickly'.

FUTURE RESEARCH DIRECTIONS

The behavioral competencies determined within the scope of this study have the potential to guide project managers in the areas where they should develop themselves. As a future study, by conducting questionnaires to the project managers, an empirical research can be carried out to get feedback about the validity of the competencies determined in this study. Additionally, studies can also be carried out to measure the readiness level of project managers regarding the determined competencies.

Different sectors can also be the center of attention. The required project manager competencies may vary from one sector to another. In addition to that, the state of the organizations can also affect the required competencies. The comparisons that will be made in the above-mentioned areas may produce categories of project manager competencies that differ according to the sector or state of the organization.

CONCLUSION

Today's customers are much more conscious about their purchases. Together with the new supply chain structures, they play a much more active role in production systems. New type of customers, who have strict rules about what functions the products have to perform and how they should look like, force companies to update their way of doing business, and additionally, request to have a say in each stage of the production process. By the solutions provided by I4.0, these customers have the chance to be involved in the production chain earlier and push these organizations to offer more individualized products. Therefore, to be successful in the ongoing transformation process, organizations need to understand the changing customer demands and preferences, and need to develop new digital products and services shaped by digital technologies that the customers will be willing to buy. At this point, the need to benefit from extensive customer data (unequivocally by taking security and privacy issues into consideration) is a key requirement for all companies.

The processes concerning the digitalization, big data collection and security of this data necessitates the development of new business models and brings up the issues such as collaborative interactions and management support. Designing new business models through digital innovation, transforming traditional corporate architecture into a modular architecture that can seamlessly connect with new digital technologies to compete with emerging new competitors, and attracting new capabilities that can integrate digital technology expertise with technical know-how, could be given as examples of managerial challenges faced throughout the transformation process.

The fact that the physical and organizational boundaries dissolve because of new environmental conditions, compels companies to move faster and to be managed more effectively and systematically. Furthermore, the management techniques that have been put forward so far will not be sufficient under the conditions created by I4.0. The flexibility need will be even higher than before, and expertise, such as, self-management and PM will be vital. In the course of this transformation process needed by I4.0, the competencies that have not been mentioned so far will expand in importance, and the number of projects performed to start new enterprises and to develop and implement new technologies, products, and services will increase.

I4.0 projects include high complexity and uncertainty regarding structural, organizational, technical, socio-political, etc. conditions and utilize new and emerging technologies. Traditional project planning approaches, which emphasize planning and control to achieve predictability over the scope, costs, and schedule of the project, express that projects can be implemented in parts and they do not focus heavily on the human factor. Therefore, it can be said that these approaches and existing strategies lose their validity for highly complex, uncertain, and time pressured I4.0 projects.

DT involves both institutional and technical transformation of organizations and becomes more applicable as innovative technologies become more prevalent. It is critical to develop a road map and understand the steps that have to be taken before starting the transformation projects. Additionally, it is very important for the project managers to play an active role in all phases of the transformation strategy.

The application of the relevant new technologies is only possible with the guidance of project managers in decision making and strategizing at all levels (i.e., strategic, functional and operational).

When a general framework of I4.0 is tried to be drawn, there are some keywords that need to be underlined: automation, being smart, digitalization, personalization, decentralized control, and flexibility. These keywords shed light on the processes that businesses have to go through. Accordingly, project managers have to run projects in new type of digital enterprises using new technologies. It is inevitable for these changes to shape the main competencies of project managers to fulfill their responsibilities.

In line with all the developments that have taken place so far, the impact of DT on project managers' competencies is examined in this study by analyzing existing PM literature and I4.0 literature. Within the scope of the study, the competencies compiled from the current PM literature were listed and evaluations were made concerning the impact of DT on project managers' competencies.

As a result of the evaluations, two important conclusions were reached:

- 'Multicultural Approach', 'Change Management', 'Flexibility', 'Development Management', 'Initiative', 'Customer Orientation' and 'Innovativeness' are among the competencies that will become progressively more important in the future.
- 'Digital Transformation' and 'Data Analytics' competencies are among the competencies that were not critical in the past, but have emerged to be important at present, in a DT environment.

Besides achieving these behavioral competencies, whose contents are detailed in previous sections, it is also very important for project managers to improve themselves both on technical and on social issues, such as, 'communication' and 'cooperation'. Verhoef et al. (2019) stated that along with digital resources, growth strategy, metrics, and goals, an organizational structure is a strategic obligation of DT. For the flexible organizational structures needed in the digitalization process, PM practices should be more integrative, responsive and attractive, and project managers should be more mobile on one side and work virtually on the other side (Thiry, 2013). One of the most critical points to be considered for digitalization is the creation of a working environment that consists of employees who are open to change and strive to gain new competencies (Wahlund & Wahlberg, 2018).

New approaches for the management of the transformation process, such as innovation by experimenting, transformation through incremental steps, and advantages through an evolving portfolio of temporary ones have been proposed (Li, 2020). All enterprises will have to undergo a transformation process that consists of numerous projects in social and technological fields. Therefore, a digital enterprise will be possible with the guidance of a strategy that focuses on possible new management approaches and emphasizes the undeniable importance of transformed management practices and PMs throughout the whole process.

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KEY TERMS AND DEFINITIONS

Artificial Intelligence: Systems that continuously learn by imitating the human mind.

Augmented Reality: The assembly of virtual images and real images with the help of object identification technologies.

Autonomy: The smart actions of a system, using the knowledge gained from itself or its environment without any interference from the outside.

Decentralized Control: A controlling system in which the units are able to use the communication channels to control their own actions.

Digital Enterprise: A business that utilizes technology in its operations.

Digital Strategy: A plan of action that utilizes digital resources to achieve a goal.

Digital Twin: The virtual equal of a real physical system.

Innovation Strategy: A plan of action that focuses on the improvement of technology or services.

Internet of Things: The smart network formed by the connection and communication between objects.

Chapter 15
Strategies for Digital Transformation of the Public Acquisitions Systems:
Lean and Agile Management to Avoid Waste and Corruption

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ABSTRACT

This chapter aims to study the digital transformation strategies of public management and, within this, the analysis of the main aspects of the transformation of the public acquisition system. It is based on the new public management approach, its evolution towards post-new public management, as well as other strategic derived approaches, such as all government, good government, united government, or government of the digital age. The application of lean and agile methodologies is a great facilitator to support the digital transformation processes of public administration, and far from being incompatible, they are complementary and combinable. This work focuses on the design of strategies for the restructuring of public investment and procurement systems, a critical part of public management, making them more effective and efficient, seeking a greater rationalization of public spending, as well as avoiding waste and corruption.

INTRODUCTION

This work aims to study the new strategies that are necessary to promote the digital transformation of the public acquisitions system. It proposes to make this system more effective, efficient, and economical, considering a strategic, integrated, and digital approach.

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Society has undergone major transformations during the last decade, changing not only the form of living but also the way governments act. Among other important aspects, it has been possible thanks to the digital impact of new information technologies as well as the diversification and multiplication of communication channels and the management tools. This has allowed the majority of the population to access information in real time from different parts of the globe, expanding the expression scenarios of individuals, and all this in an increasingly integrated world in which free exchange of products and services around the planet is facilitated. All these dynamics have converged in a new perspective of the State from a liberal approach, in which the power of the state sphere is reduced, giving rise to the stimulus of private initiative (Vyas-Doorgapersad & Aktan, 2017). These processes have had an impact on the emergence of new demands from the population to governments, modifying historically established relationships between the public and private sectors. In this way, citizens have begun to demand less state intervention in private affairs and a renewed sense of public affairs has been consolidated, characterized by greater control over the actions of public institutions. Governments have seen their margin of action reduced due to the erosion of interventionist models and the emergence of important reorganization dynamics in the private sector, which have successfully replaced the State in the provision of public services and the satisfaction of the needs of citizens. It is essential to modernize the public administration, moving from the traditional bureaucratic state to a more flexible, efficient, transparent, and oriented scheme to meet the demands of civil society (Anheier et al., 2019).

This is the approach of the so-called New Public Management that is characterized by adapting business management tools to the management of public affairs, and that advocates the provision of services more adjusted to the needs of citizens, with a focus on efficiency and effectiveness in satisfying social demands, stimulating leadership and technological innovation in the public sector (García Sánchez, 2007). Likewise, by placing the citizen at the center of the model, it introduces a fundamental break with the traditional perspective, since the final objective of the public administration is to process citizens' demands effectively, thus guaranteeing the provision of quality services and adjusted to their needs. The objective is to modernize and profoundly transform the public sector, making the citizen equal to the client. It is proposed to favor the introduction of competition mechanisms that allow a higher level of citizens' choice and in turn promote the development of higher quality public services. This can be carried out by implementing new control systems that guarantee full transparency of processes, plans and results, so that on the one hand the election system is perfected and, on the other, citizen participation is favored.

With the beginning of the 21st century and especially in its second decade, a new conception about the excessive commercialization of public entities and the high levels of un-coordination between entities extends (Funck & Karlsson, 2019). The so-called Post-New Public Management arises and advocates a more centralized reorientation of the public sector and cooperation between public and private organizations (Klenk & Reiter, 2019). Both the New and the Post-New Public Management have the flexibility to adapt their models and tools to multiple contexts, adapting their execution to the needs and dynamics of each society. It is necessary to have the political capabilities that allow complex decision-making to be confronted in the face of changing the environment, which should allow to guarantee the integral sustainability of the public sector through a progressive line of action that eliminates waste in the short term, increase the medium-term efficiency, and finally achieve a global strategic transformation of the public sector, using as main support and development vector the complete digital transformation of its structures.

On the other hand, the current situation of the public sector in many of the countries experiences a situation of risk of financial collapse due, among other things, to factors such as: the strong indebtedness

of the public, the private and the banking sectors, which restrict the ability of economic growth; low competitiveness in a disruptive global environment that requires permanent technological adaptation; an excessive dimension of the public sector in many countries; complex tax systems whose collection capacity is depleted, along with the imperative need to reduce the public deficit; a culture of dysfunctional public spending emphasized by waste and corruption; etc. In addition, there has been a loss of credibility of the public sector as administrator of the welfare of citizens that is accompanied by demonstrations that require public institutions to act applying principles of greater economy, efficiency, and effectiveness.

As a result of all this and to make the development of the digital transformation processes derived from the New and Post-New Public Management more feasible, it is necessary to transform and redesign the public acquisitions systems in a more effective, efficient and economical way, oriented to the implementation of a strategic, integrated and digital public procurement management.

To know the current international panoramic situation of public acquisitions systems, the OECD reports on the evaluation reviews of said systems carried out in the countries that belong to this Organization have been analysed (OECD, 2020). It can be summarized using the report issued by the OECD Public Procurement Council on the progress of the transformation process that was established in 2015 (OECD, 2019):

- The perceptions and data used by the OECD countries show evidence of the use of public procurement to achieve strategic overall policy objectives.
- The processes and institutions are increasingly in solidarity with the strategic results of the concentration of acquisitions. Since 2014, an increasing number of countries have established collaborative procurement tools, such as the use of framework agreements, which allow for the aggregation of purchasing power and the reduction of administrative costs.
- There is also a growing trend in the use of other criteria beyond price in the evaluation of offers linked to their quality. The anticipated costs of using purchased being over its lifetime are also increasingly being considered, including social costs such as greenhouse gas emissions.
- The assessment of national procurement systems is evolving rapidly, in terms of measuring the impact of public procurement on complementary policy objectives. With increased data collection and availability, system-wide impacts are more easily measured, and countries are better equipped to make insightful evaluations of their public procurement systems. However, the systematic evaluation of procurement results remains a challenge in most OECD countries. Only a minority of countries have a formal performance management system, with key performance indicators (KPIs) that reflect specific results and objectives for each contracting authority. In contrast, some of them have developed and are monitoring specific indicators related to complementary policy objectives, for example, green public procurement (GPP), social problems, participation of SMEs and innovation.
- Beyond processes, an effective shift from the procurement function towards strategic governance requires a lot of support. In line with the digital transformation of public services, the use of electronic contracting systems is increasingly widespread, and the use of digital technologies is beginning to be used to collect meaningful data, to measure the effectiveness and efficiency of public spending.
- The skills and capacities of public officials are also crucial in supporting effective change in the public sector. The public procurement workforce continues to lack both management capacity and sufficient leadership capacity.

- Finally, the increased complexity and interconnectedness of procurement-related problems requires rigorous and comprehensive risk management. The legal frameworks used act as a first barrier to certain risks of waste and corruption, but it is insufficient.

The proposals made by the OECD have been internationally recognized and used to incorporate holistic transformations of public acquisitions systems, to support a paradigm shift and its conversion into a strategic tool of public governance. However, there is still a long way to go and new strategies need to be identified to catalyse the implementation of the necessary changes in public procurement systems, among which its digital transformation would be possibly the most significant.

This chapter aims to study the strategic aspects of said digital transformation, as well as the main concepts that are necessary to implement, the keys to advance, and the main existing barriers. The chapter has three sections. First, the literature on the main concepts and trends of the strategic approach known as New and Post-New Public Management is reviewed. Second, the application of lean and agile management approach is studied as the basis of a new culture for public administration to avoid waste and corruption, and a catalyst for its digital transformation. Finally, the transformation strategies of the public procurement system are analyzed, to develop a strategic, integrated, and digital management.

RESEARCH METHODOLOGY

The approach and the development of the work have been carried out using a qualitative research methodology, by applying a descriptive and explanatory method on the research problem, generating new orientations, approaches and trends to guide a possible solution.

To obtain an overview of the current international situation of public acquisitions systems, various evaluation reports carried out by OECD experts in various countries in recent years have been analysed. Likewise, the report issued in 2019 by the OECD Public Procurement Council on the progress of the transformation process that was established in 2015 has been studied and synthesized.

The reviewed literature has been used to include essential concepts and approaches on the problem. The review has been carried out with a level of detail that is considered sufficient, seeking its original aspects to guarantee objectivity and avoid interpretative biases. An attempt has been made to perceive the reality of the problem integrating and making coherent these concepts and the analysed phenomena of the researched problem.

NEW AND POST-NEW PUBLIC MANAGEMENT

From Traditional Bureaucratic Model to New Public Management

According to the name of the New Public Management that Christopher Hood used for the first time (Hood, 1991), a generalized reform program was proposed that was implemented in practically all OECD countries and beyond (Hood, 1995), and that implied the introduction of corporate-type changes in public sector organizations, including the replacement of hierarchical coordination with competition, the market mechanism to improve the efficiency of public services, or the introduction of a product culture aimed at strengthening accountability (Lindberg et al., 2015). This new approach emphasized since its inception

the application of the concepts of economy, efficiency and effectiveness in government organizations, as well as in political instruments and their programs, trying to achieve total quality in the provision of public services, and dedicating less attention to procedural requirements dominated by legal and non-optimized management approaches, standards and recommendations (Leeuw, 1996).

Thus, this moving concept of public action is structured based on a new scenario, with two basic aspects. On the one hand, the public sector reduces the differences with respect to the private sector in terms of personnel, remuneration systems and management methods; and on the other hand, there is a decrease in the volume of rules and procedures that articulate the management actions of public departments, subject to uniform rules for contracting and incurring costs (Dunleavy & Hood, 1994).

On the one hand, there is the paradigm of traditional bureaucratic administration, structured on the basis of the Weberian model and characterized by the formality of institutional communications, the thorough regulation of procedures, the strict division and specialization of tasks, the rigid hierarchy within organizations, and adherence to standardized routines and procedures. On the other, various administrative methods that seek to promote less expensive, more effective, and efficient public management, which began to be implemented in some countries since the late eighties of the twentieth century.

Many of the contributions of experts for the realization of this new approach, analyzed the need to develop and improve control tools especially oriented towards the evaluation of the results obtained with the management of public resources. Some associate it with the introduction of concepts, practices and techniques from the private sector (Fernández-Rodríguez, 2000), aimed exclusively at the control of results (Boden et al., 1998), or oriented towards the introduction of improvements in management through deregulation, decentralization and the introduction of competence and transparency in accountability (Coninck-Smith, 1991).

We could synthesize that the New Public Management pursues the creation of an efficient and effective administration, that is, an administration that meets the real needs of the citizens at the lowest possible cost, favouring the introduction of competition mechanisms that allow the election of users and in turn promote the development of higher quality services. All this surrounded by control systems that grant full transparency of the processes, plans and results, so that on the one hand, they perfect the election system, and, on the other, they favour citizen participation (García Sánchez, 2007).

The implementation of this new public administration model implies not only a process of institutional reengineering, understood as the modification of the norms that delimit the actions of public organizations, but also a profound transformation of the behavior patterns that govern relations between agents of the public sector, and between them and the private sector. Such dynamics of change tend to generate resistance among various agents that may see their power niches compromised in the State, so the application of the New Public Management requires a holistic approach to change management that allow to transform the structures, processes and culture that predominate in the management of the public and public-private issues.

The processes of change generated by the implementation of the New Public Management can essentially be framed into four broad categories:

1. *The rationalized State.* It consists of analysing what the needs of citizens are and what the private, public or public-private agents can provide them with, under greater efficiency and quality, so that the State does only what citizens cannot achieve on their own. Same in the market. In the rest of the cases, the role of the Public Administration must focus on the regulation of services and the strengthening of synergies between the public and private sectors, to meet citizen demands. The

rationalized State is closely related to a form of administration focused on the so-called lean and agile management, which is aimed at achieving economic efficiency through a process of permanent improvement of the services provided, the exploitation of the potential of public workers, the orientation to the achievement of objectives, and a horizontal and process-based organizational structure. Later we will analyse it in more detail.

2. *The separation of strategic and operational levels*. The strict division of the political and administrative spheres is fundamental for the New Public Management, insofar as the first is framed in the field of strategic management, in charge of defining global policies and their application criteria, while the second level assumes an operational role that specifies how services are provided to citizens, which is based on the general guidelines established at the strategic level. This division of responsibilities allows each sphere to specialize in what it does best, reducing the risk that political interests will skew the application of the programs, or that it is the technicians who decide the nature of public policies.
3. *A new attitude of service*. Given the importance granted to the citizen in the new approach, an essential element of the processes of change points to a new attitude of service, in which the public administration ceases to be conceived as a coercive instrument endowed with sovereignty, and begins to be perceived as an organ whose role is to provide services to society. This implies that public management is oriented towards the identification of citizens' demands and their satisfaction, through efficient, effective, and quality mechanisms.
4. *A new management model with new technological tools*. The New Public Management is based on a management model inspired by the management structure and organization of private companies, whose main characteristics are results-based management, market orientation, competition promotion, product focus, total quality management and an accountability scheme on results. This model allows focusing attention on the processes and ensures that the products or services generated by the public administration respond to the needs of citizens efficiently, and with high quality standards.

These characteristics suppose a series of advantages with respect to the Traditional Bureaucratic Model, in that it provides technological tools and new methodologies to managers and public workers to execute their tasks in a flexible, efficient and transparent way, stimulating leadership and innovation in the public sector, particularities that have been traditionally associated only with the administration of private companies.

Also, by putting the citizen at the center of the model, it introduces a fundamental break with the traditional perspective: the final objective of the public administration will be to effectively process the demands of citizens, guaranteeing the provision of quality services adjusted to their needs.

However, the New Public Management is not a recipe that can be applied directly in any country. On the contrary, the models and their tools must be adapted to multiple contexts, adapting their execution to the needs and dynamics of each society. In addition, the new approach needs to implement structural and cultural changes that are not only achieved by the enactment of certain regulations but are about processes of gradual transformation of the behavior patterns of public workers and citizens. It is also necessary to remember that, despite the fact that this model is inspired by private management tools, the specificity of the nature of the services provided by the State should aim to ensure the general well-being and guarantee the fulfillment of the rights of citizens.

From New Public Management to Post-New Public Management

The reform processes that have been implemented within the New Public Management have found certain criticisms. Among others we can highlight an excessive decentralization, diffuse vertical control, lack of horizontal coordination among the organizational units, a strong focus on the results and management evaluation, and the distancing of the generalizing and overall vision of the well-being of citizens (Arellano & Cabrero, 2005) (Christensen & Lægreid, 2007 a) (Christensen et al., 2008) (Diefenbach, 2009).

The set of reforms that have been proposed in the organizational structures in order to disaggregate the public sector entities, have resulted in greater fragmentation of the functions to be performed, and a certain ambiguity in the definition of the same, with an excessive level of vertical specialization and little cooperation between the different bodies and agencies. On the other hand, decentralization, management measures and accountability systems, as opposed to the intended flexibility they pursue, have introduced control mechanisms that limit the management autonomy of those responsible for administration activities in the sector public (Christensen & Lægreid, 2007 a) (Diefenbach, 2009) (Goldfinch & Wallis, 2010). Finally, the excessive focus on efficiency has led to the marginalization of traditional principles of the public sector in the provision of goods and services, such as neutrality, social justice, or social welfare (Arellano & Cabrero, 2005).

Faced with these difficulties, a process of criticism and revision of the New Public Management has begun, whose main result has been the development of new approaches, for whose conceptualization many public administration academics frequently use the term Post-New Public Management (Christensen & Laegreid, 2007 b) (De Vries & Nemec, 2013). This new approach describes the general panorama of a reform that during the last fifteen years has created a hybridization of the public sector and of the organizations that operate within it. Many authors share the need for a new perspective. In view of the approach by which large bureaucratic organizations have become more flexible and disaggregated into smaller control units that are very difficult to coordinate, a reconfiguration with a set of interconnected approaches is necessary (Goldfinch & Wallis, 2010), whose main objective is cooperation and collaboration, both within public organizations and with private entities, for which a process of centralization and coordination must be carried out (Christensen & Lægreid, 2008) (Pollitt, 2009). For all these reasons, a review of Weber's bureaucratic theory postulates has been encouraged, insisting on the re-centralization and re-organization of public administrations.

Within the framework of the Post-New Public Management reforms, one of the proposed instruments for its effective control was the so-called Whole of Government. This concept is configured as a set of responses to an excessive fragmentation of the public sector, promoting its structural reorganization so that the different organizations can cooperate and work together, in order to improve both vertical and horizontal coordination, and with the purpose to offer citizens a more integrated service (Pollitt, 2003). From a cultural point of view, this instrument tries to reinforce values such as trust, collaboration, teamwork and the improvement of training and self-development of public workers (Christensen & Lægreid, 2007 b).

In the same way, another trend that has significantly influenced the way the public sector is managed has been Good Governance, whose main approach was to advocate the providing of a system of responsibility and trust to the administration vis-à-vis citizens, its main stakeholder (Cadbury, 2000) (OECD, 2005). This approach involves a way of measuring how public institutions conduct public affairs and manage public resources in a preferred way. It emerges as a model to compare inefficient economies or political organizations with viable economies and political bodies, so that, in addition to

customer orientation, greater transparency and accountability are promoted as well as greater openness and participation of citizens (the citizen as "goal" and as "mean").

On the other hand, the approach of the Joined-Up Government is a new term coined for an old administrative doctrine of coordination. In a general sense, coordination in the old administrative doctrine suggests that all the parts of the executive government should be interconnected and complementary to one another. The aim of coordination in the government is to be able to present a single face to the society and to operate as a single unit on multiple yet interrelated problems (Carey & Harris, 2015).

During the last years, digital technology has become the support base for achieving integrated and coordinated public services and administrations (Dunleavy et al., 2006).The great variety of changes connected and focused on the new information and communications technologies have generated a new approach that incorporates all the new changes towards the Digital Age Governance, which implies the reintegration of functions in the governmental sphere, the adoption of holistic structures oriented to the needs of citizens, and the progress of the digitalization of administrative processes. This approach offers a perhaps unique opportunity to create a self-sustainable change, in a wide range of closely related technological, organizational, cultural, and social effects (De Vries & Nemec, 2013).

Work is currently underway on the transformation of the public sector through specific synthesis solutions, obtained by integrating the four approaches, seeking the composition of integrated public services based on collaboration and coordination between public bodies (Kernaghan, 2009). These new adaptive approaches are not without criticism for the variety and ambiguity of techniques and measures that maintain both traditional bureaucratic schemes and the New and Post-New Public Management (Goldfinch & Wallis, 2010).

However, other authors consider that public management models should not be closed since the implementation of management reforms. This cannot mean the total abandonment of the structures, instruments, and characteristics of previous models (Dunn & Miller, 2007). Each public administration will need to carry out an analysis of the possible alternatives and the different possibilities offered by the available models, as well as the various previous experiences carried out in other countries to adapt and implement those measures that are most appropriate (Jun, 2009).

A comparative table of the main characteristics of Traditional Bureaucratic Model, New Public Management and Post-New Public Management is shown in Figure 1.

Digital Transformation of Public Administration: The Implementation of Disruptive Technologies

Digital transformation can be defined conceptually as the process of organizational, cultural, and strategic reinvention not only of companies but also of public entities (Assar & Hafse, 2019). This is necessary for the comprehensive application of the technology we call digital, which generates, processes, stores and uses data, information and intelligence, to improve its performance and its ability to quickly adapt to disruptive or radical changes generated in the environment (Mergel et al, 2019). An important approach is to formulate a digital transformation strategy that serves as a central concept to integrate all the coordination, prioritization, and implementation of digital transformations within a company (Matt et al, 2015). Digitization is affecting all public and private sectors, creating disruptive leaders, and generating new business opportunities. Entities must constantly deal with an increase in the complexity of the environment and its generated goods and services, with shorter and shorter life cycles. To survive the effects of disruption, organizations must rethink all aspects of their business, and try to become digital

enterprises, obtaining competitive advantages from the application of disruptive technologies to create new business opportunities (Kühn, 2019).

Figure 1. Comparative of the main characteristics of Traditional Bureaucratic Model, New Public Management and Post-New Public Management
Source: García Sánchez, 2007

	TRADITIONAL BUREAUCRATIC MODEL	NEW PUBLIC MANAGEMENT	POST-NEW PUBLIC MANAGEMENT
SETTING	Centralization: horizontal coordination	Decentralization: vertical coordination	Re-centralization: horizontal and vertical coordination
CONCEPTION OF THE CITIZEN	Application of legality: Citizen - Managed	Customer Satisfaction: Citizen - Client	Citizen orientation. Responsibility and accountability. Citizen participation..
REGULATION	Administrative law	Flexibility: escape from the administrative law. Contract formalization.	Administrative Law. Openness and transparency.
PROCESSES	Standardization: administrative procedures	Process orientation: techniques and procedures of the private sector.	Management professionalization
STRUCTURE	Hierarchical structure	Control units	Work networks. Cooperation between organizations.
EVALUATION	Authority and control	Control and evaluation of results (output)	Management control and evaluation (outcome)
HUMAN RESOURCES	Bureaucratization of public workers	Professionalization of human resources	Professionalization of human resources

To analyse the concept of digital transformation in public administration, it seems useful to highlight the main stages of digitization. Three main stages are usually identified, highlighting the role of digital technologies as tools for the modernization of the public sector (OECD, 2016):

- Digitalization of processes, in the framework of which the implementation of traditional digital technologies is carried out to improve government efficiency, data management, etc.
- Electronic government, which involves the introduction of digital technologies, especially based on the use of the Internet, to improve public administration.
- Digital government, in which the latest generation digital technologies allow it to consider the preferences expressed by users in their behaviour to the formation of the composition of the supply of public sector services.

In this area of public management reforms, it is necessary to know in detail the keys to obtain a more rational management of public spending that is efficient for the economic reference system. It is necessary to implement new public procurement models, through a strategic orientation and an integrated organization. Based on the digital transformation of its systems and the application of disruptive technologies (such as Data Science, Big Data and Business Analytics, Artificial Intelligence, Blockchain,

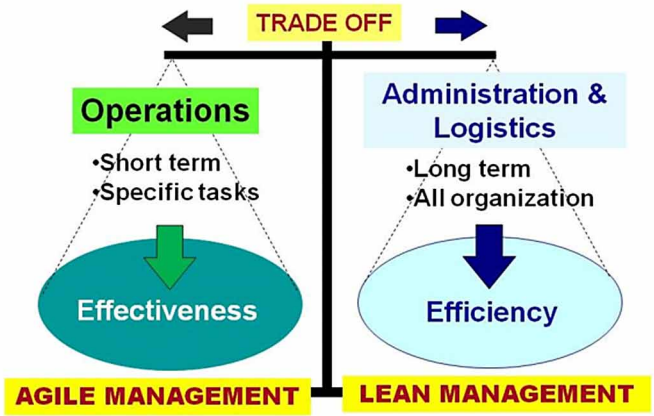
IoT, Simulation Systems, Machine Learning, etc.), the new acquisition model of the public sector should concentrate on a supply focused on the management core of the strategic acquisition, the redesign of organizations, and a new set of management skills.

Based on the analysed approaches of the Post-New Public Management reform, such as Whole of Government, Good Governance, Joined-up Government or Digital Age Governance, the new public acquisitions models require the use of new management tools such as Business Process Management, Process Reengineering, Public-Private Partnership, Cost-Benefit Analysis, Public Marketing, Social Marketing or Public Value Management, and specially framed in a new efficient culture of the Public Administration, such is the lean & agile management concepts.

AGILE AND LEAN MANAGEMENT: A NEW PUBLIC CULTURE TO CATALYZE THE TRANSFORMATION

The feasibility of the proposed improvement needs to address its strategic implementation through the application of lean and agile management techniques, tools, and methodologies. Far from being both incompatible methodologies, they are strongly complementary to the improvement of the functioning of the organizations, being their main differences regarding their operation and the aspects of the organization to which they apply, the following (Figure 2).

Figure 2. Agile Management & Lean Management
Source: Own elaboration



- First, lean management comes from the production and logistics sector, while agile management comes from the development of IT projects.
- Second, lean management is a long-term process improvement system, while agile management is used primarily in structures that act in the short term in which rapid decision-making is necessary.
- Third, lean management manages the general work and continuously of the organization as a whole and applies to all areas to be more efficient, while agile management focuses on specific

tasks to make good fast decisions, solving problems in the best possible way, in the shortest possible time.

- Finally, agile management is especially useful in the field of operations in which the effectiveness of activities is essential, while lean management is the fundamental methodology in administration and logistics activities in which efficiency is the key.

Lean and agile management are simultaneously opposing and complementary. Different authors consider strategies must combine lean management and agile management since it is necessary to answer to different needs, low costs (lean) and quick responsiveness (agile), both highly valuable for efficient and effective performance (Vázquez-Bustelo & Avella, 2006) (Aronsson et al, 2011).

Agile Management

Today's dynamic and uncertain environment requires quick reaction to change and frequent deviations from plans, making agility indispensable. The concept of agile management consists of an interactive methodology that values communication and human feedback, which adapts quickly to changes and produces tangible results (Christopher, 2000).

Changes in consumer trends, strong competitiveness, and continuous innovation force organizations to boost their management processes, the assignment of tasks and the definition of protocols. Conventional work methods, in which fixed deadlines were set and the actions to be carried out defined and delimited, without the possibility of changes, are things of the past. These traditional approaches involved high costs and a huge amount of work often useless (Christopher & Towill, 2001).

For all this, agile management has been gaining adherents among many companies, regardless of their size and sector. At the beginning it was a characteristic technique of organizations in the technology and software industry, but now it is useful for any organization that operates in unstable contexts and, therefore, needs flexibility and the ability to adapt quickly to change.

Agile management includes a set of methodologies that consist of dividing projects into phases or tasks, to test them on the fly and thus see if they work or if changes must be applied. Throughout this process, the initial concept often changes (Sajdak, 2015).

Depending on the size of the project, a team is involved in each task, whose key action will be to fulfil specific objectives and progress in the workflow. The approach is very useful because it allows to optimize time, coordinate teams, assign tasks as well as plan a strategy with much less effort and resources. The agile methodology consists in producing functional and tangible results after each iteration.

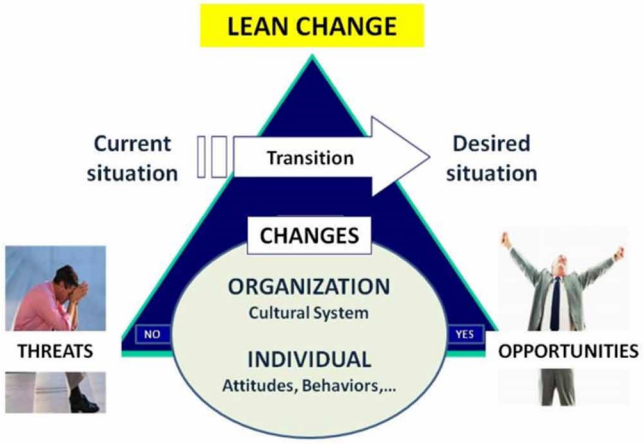
The agile methodology is iterative, which implies that it is done in phases. In each phase, the lessons learned in the previous ones are applied to improve. This is where the framework known as Scrum comes into play (Agile Projects, 2020). It is a process in which a set of good practices are applied regularly to work collaboratively as a team and obtain the best possible result of projects, characterized for adopting an incremental development strategy instead of the complete planning and execution of the product. The quality of the result is based on the tacit knowledge of the people integrated in self-organized teams, rather than on the quality of the processes used and overlap the different phases of development instead of performing one after another in a sequential or cascade cycle. The agile methodology is also a way of thinking.

Lean Management

The methodological concept of lean corresponds basically to everything related to obtaining the correct results, in the right place, at the right time, in the right amount, minimizing waste, being flexible and open to change (Hinterhuber, 1994).

Applied to the productive logistics field, in which it has had its maximum development so far, the lean methodology incorporates a series of interdependent disciplines designed to impact the productivity, quality and culture of an organization (Shadur & Bamber, 1994). Any of these independently applied disciplines would help the organization improve, but if they are implemented together in a holistic and holistic manner, a significant synergistic effect are generated that will allow the organization to catalyze much more productivity and operational performance (Lin & Hui, 1999). This implies improvements that transform the threats in the current situation into opportunities that would be exploitable in a desired future situation, through changes in organizational and individual behavior of the different actors (Figure 3).

Figure 3. Lean change
Source: Own elaboration



The core of lean management can be summarized in five general principles (Womack & Jones, 1996) (Drotz & Poksinska, 2014):

- *Defining value by the end customer:* Move away from a focus on the provider perspective on value to the customer perspective on value. This requires close collaboration and interaction with the customer.
- *Mapping the value stream:* Identify the parts in processes that do and do not add value. Change those that do not add value accordingly.
- *Creating flows:* Establish work processes that flow smoothly across occupational and organization boundaries. These boundaries should not disturb the creation of total value.
- *Establishing pull*: Respond to the customers' needs rather than the suppliers' needs.
- *Seeking perfection:* Standardize processes and make them transparent so that they contribute to continuous improvement.

The basic principle of lean thinking means moving towards eliminating all waste to develop activities that are faster, more reliable, produces higher quality products and services, and above all, with lower costs (Slack et al, 2004). Therefore, its main objective is to increase the efficiency of production through the complete elimination of waste, understanding as waste everything that in terms of time, cost, and labor, does not add value from the customer's point of view.

The identification of this waste is the first step towards its disposal, which can improve efficiency. For this, a systematic problem-solving process is generated to discover the root cause of waste and its elimination. In our opinion, problem solving creates knowledge, which allows a better understanding of its processes and the improvement of its organizational performance (Fernández-Villacañas, 2020).

The Application of Agile and Lean Management to the Field of Public Management

The integrated application of the lean & agile methodology generates a new leadership approach that creates and maintains a dynamic culture of continuous improvement through a synergistic system with the best strategies, techniques, and ideas. Therefore, very relevant approaches are considered to implement the change towards organizations oriented towards excellence, whose application to the public sector will lead to the improvement of the effectiveness and efficiency of the organization, the improvement of customer orientation, and a better overall performance of the core of its activities (Radnor & Walley, 2008).

The benefits of implementing these solutions in public administration are shared among all members of society. The users of public services develop increasingly demanding expectations, faster changes, more innovative designs, lower tax desires, ease in processing procedures, and perfect quality always. Faced with such expectations, in the face of strong pressures to reduce costs, and with increasingly reduced reaction time margins, lean & agile management becomes a key factor in streamlining and eliminating waste of operational and administrative processes of the different public organisms (Radnor & Boaden, 2008). Thus, the viability of the proposal for reform and improvement of public administration needs to address its strategic implementation through the integration and application of lean & agile methodologies that allow:

- Break with traditional thinking and energize the implementation of a new more functional organizational culture.
- Facilitate the incorporation of citizens' expectations and demands to the objectives of public organizations, encouraging participation and adapting the offer of public services to the real social needs.
- Streamline and optimize the duration of internal processes, eliminating waste of resources.
- Promote greater rationality of public spending by inducing the generation of greater efficiency of the economic system and reduce corruption.
- Facilitate the global adaptation of organizations to political strategies, making the alignment of staff with the overall objectives of the organization more feasible.
- Implement a visual management that makes the processes more visible.
- Facilitate the digital transformation of public sector structures, as a catalyst and normalization mechanism for change.

- Implement a new public procurement system that allows to increase the effectiveness and efficiency of public spending, rationalize the determination of needs, better manage the global demand for such needs, and effectively and efficiently manage the execution of contracts.

Likewise, the use of these new methodologies as the core of the Post-New Public Management is considered to face two challenges that the social environment demands:

- *Maintain and improve the provision of high-quality public services*. The changes in the environment have given rise to a demanding citizenship, with renewed needs and with expectations that they hope to achieve from democratic legitimacy. The effectiveness and efficiency of the provision of public services adapted to new needs is the main challenge for the public sector at the present time. However, it is not enough to improve the quality of benefits; these improvements must also be perceived as such by all interest groups of public organizations and mainly by citizens, generating satisfaction and confidence in management, and by public workers, improving their motivation and professional involvement.
- *Manage public spending more rationally and reform public procurement systems to avoid waste and corruption*. It is obvious that such transformation is not possible with the scheme of traditional public spending and the use of available resources, resources that in many cases are oversized with poor planning activities, of dubious results, and even directly obsolete. In addition, sometimes even to the detriment of other projects potentially more effective and efficient ones that could achieve the same or better results using fewer resources. A commitment to flexibility is also necessary, which allows prioritizing public policies in budgetary difficult times, without diminishing citizen satisfaction, and allowing both to enhance the image of the organization and its management.

The main contribution of lean & agile management, therefore, will be the creation of "social value" to the citizen that will be carried out on the following dimensions:

- *The improvement of the public administration's relationship with the citizens*, through: a higher quality of the services provided, greater information and accessibility to them, greater transparency, as well as making them more involved in public decisions, knowing their needs and expectations, and fulfilling the commitments acquired.
- *The internal development of public organizations*, working to improve the training, skills and diverse abilities of human capital.
- *The improvement of the internal management of these organizations*, facilitating a better definition and deployment of public policy strategies in line with the established objectives, streamlining the processes as well as guaranteeing at all times the quality of the services and the optimization of the resources, and all this measuring, evaluating and using its results as an objective basis for the improvement of public management.
- *Ensuring the continuous future improvement of the processes*, *efficiency and satisfaction of the citizens and public workers*, extending best practices, promoting productivity and increasing the motivation and active participation of all those involved in the process, as well as building clearer processes and procedures and eliminating recurring problems.

- *A boost to the modernization of public administration*, promoting the use of new technologies, knowledge management and, in short, making the implementation of the New and Post-New Public Management feasible.

Finally, in our opinion, the success of the implementation of lean & agile management will require certain essential requirements:

- The implementation of the new integrated methodologies requires the creation of a positive internal and external state of opinion, through an intense information and communication phase.
- Lean & agile management are not just some more processes; they demand a change in behavior, mentality, and performance.
- Senior management must exercise strong leadership in the process of change, influencing communication.
- The active participation and involvement of people are a strategic way to reduce costs that do not generate added value, streamline activities and responses, and thus improve productivity.
- The decision making of the improvement process must be close to the entity in which the activity is generated, and the global process adapted to the specific aspects of it.

STRATEGIES FOR DIGITAL TRANSFORMATION OF PUBLIC ACQUISITIONS MANAGEMENT

Public administration reform initiatives, based on the analysed approaches of Post-New Public Management such as Whole of Government, Good Governance, Joined-up Government or Digital Age Governance, require the support of an in-depth restructuring of public acquisitions system. It is necessary to make more effectiveness and efficient investments and purchases of current goods and services, rationalize public spending by avoiding waste and fighting corruption, as well as implement a new methodology of work and public culture, the agile and lean management already analysed, which allows to capitalize all the different possible sources of optimizations in the public acquisitions (Uyarra et al., 2020). This restructuring should not only try to address a process of centralization and inter-institutional cooperation in the field of public procurement for the exclusive achievement of economies of scale, initiatives that are evident corollary of the initiatives that are proposed, but of a profound conceptual and organizational change, that is, a new orientation of procurement through the design and implementation of a new systemic model of strategic, integrated and digital purchasing management.

So far, many of the public procurement systems in many countries have been fundamentally oriented towards complying with the principle of legality from an outstanding legal conception, through long administrative procedures. However, it is currently vital that this essentially legal approach be significantly enriched with other strategic, systemic, competitive, financial, technological, marketing, intelligence management, optimization, and other orientations and approaches that can improve social innovation (Bleda & Chicot, 2019).

It is always necessary to analyze how to improve the effectiveness and efficiency of public acquisitions in a permanent search for excellence through continuous improvement and organizational learning. In this orientation, we can highlight two aspects that can strengthen the acquisition processes, obtain quality improvements and significant savings.

On the one hand, *the integration of procurement with the previous phases of strategic planning, programming, and budgeting* is proposed. The large public sector investment structures have procedures whose application should allow prioritizing needs, analyzing all procurement alternatives, and selecting the optimal one, as well as establishing the best contracting strategy. In the definition of this strategy in the programming phase, it is essential that personnel specialized in procurement participate, since the main decisions and actions on which the success of the procurement depends are taken in these phases. Thus, for example, unavoidable consultations with companies during these phases may violate some of the legal principles of hiring or damage future competition if it is not done in a transparent manner. It is necessary to institutionalize such contacts and make them public. On the other hand, many decisions, such as those referring to the requirements and needs to be covered with each acquisition, do not often consider the contractual aspects, although they do condition them. Likewise, cost estimates are often inaccurate and almost always rely on those provided by interested companies themselves. For these and other circumstances, it is essential that procurement specialists participate regularly in strategic planning, programming, and budgeting processes.

On the other hand, there is *the need to review the organization and procurement procedures of public bodies*, whose objective would be to improve the quality of contracting and reduce costs. Quite a few of the problems that now affect procurement could be better solved if, instead of the high number, dispersion and heterogeneity of centers responsible for acquisitions, unified, specialized and homogeneous procurement organizations were established, aimed at improving quality, effectiveness, efficiency, elimination of waste and corruption.

In the first place, compared to the traditional systems through which it is difficult to exercise the direction, monitoring and control of public procurement, the organization to be proposed should have the following characteristics:

- Definition of a cross-cutting and integrated organization model, which analyzes the needs considering the global demand by families or purchase categories, and therefore, disconnected from the petitioners or plaintiffs.
- Specialization in applying the best procurement practices to obtain in quality, price and term, the goods and services demanded by those.
- Application of strategies that integrate and try to apply, together with the specific aspects of each purchase, the vision, and general policies of the entire public sector.
- Application of decisions and doctrines based on a good monitoring and evaluation system, which allows to know the effectiveness and efficiency of the purchase processes, and correct the procedures based on the lessons learned.
- Finally, a good internal system of training and management of specialized personnel in the new disciplines that have been analyzed must be available.

Secondly, the new organization should concentrate and reduce the centres with legal capacity to acquire, trying to achieve a higher level of homogenization of its processes, procedures, and tools. For this, it would be necessary to develop a package of general procedures that are supported by cyber systems, intensive in disruptive technologies, as well as in the most modern contracting techniques. The research and management of suppliers as well as the competitive analysis of the relevant industrial sectors, all carried out as part of the strategic definition procedure, could facilitate their communication

and active search, as well as prior knowledge of the real economic impact expected and capitalization of important economies.

Finally, the third basic aspect would involve the management of large investment projects, in which the contracting strategies would be integrated, as well as the financial and cost implications, thus guaranteeing the necessary improvement in the efficiency of the procurement process. It would be necessary to develop an integrated logistics management, in which from the beginning of the identification of the operational need, multidisciplinary teams would analyse the processes permanently using digital technologies. These teams must make multi-criteria decisions that integrate operational criteria, technological and logistical aspects, as well as strategic concepts of market, finance, contracting and digital management.

However appropriate the technical and operational processes of strategic planning, programming and budgeting are formulated, the real validity of decisions will be scarce if certain aspects that can limit or strengthen them are not taken into account from the beginning: the competitive situation of the markets, realistic price estimates, the object of perfectly defined acquisition, procedures for processing and adjudication, advertising, etc. In this way, it is convenient to have throughout the development of such processes of simulation systems of acquisition alternatives that would allow to study the different possibilities, properly plan the contracts, and facilitate their subsequent monitoring and control. And incorporating actions to begin their activities from the beginning, and equipping the systems with big data, business analytics, and artificial intelligence tools to implement them.

And as a last integrative reflection, it would be necessary to provide, in addition to the necessary procedural guidelines and identification of cybernetic support tools, an action methodology that guarantees the optimal design of the new implant procedures, an orientation of continuous improvement and organizational learning, as well as share such learning transversally among the different projects developed. Obviously, such support methodology, as we have pointed out, could be agile and lean management since it represents the most appropriate philosophy to boost the design of the new ad hoc procedures, within the digital transformation process.

SOLUTIONS AND RECOMMENDATIONS

The evolution and transformation of public administration at an international level through different approaches and models, has been a permanent process during the last decades, and a very active field of research for academics and experts in political science and administration. The modernizing current of the public sector has tried to improve and make public policies more related to society, by increasing the effectiveness and efficiency of public management, and rationalizing public spending.

Within this approach, as a generic object of this work, one of the essential dimensions corresponds to the improvement of public acquisitions systems, on whose transformation and optimization, beyond legal studies, there are few comprehensive and multidisciplinary academic studies made on its redesign, reorganization and optimization of its procedures.

The area of investments and public procurement is a field that should be considered critical to guide public management towards excellence, and we are convinced that it offers today and will offer in the immediate future, attractive opportunities for academics and public professionals to give their valuable and necessary contributions.

FUTURE RESEARCH DIRECTIONS

The analysed field of the transformation of public management in general and of its procurement systems, suggest a clear evolution towards the development of strategic, integrated, and digital management structures and models, which raises interesting and leafy interdisciplinary research lines. Among them, on the one hand, it is necessary to generate specific procurement models for each sector of activity, with empirical criteria, specifying the strategic, organizational, and functional aspects. The debate about standardization vs. adaptation will be present in this type of studies. On the other hand, there is a very interesting field of application to the new acquisition models of the mix of disruptive technologies that can support the improvement of processes, such as Big Data, Business Analytics, Artificial Intelligence, Learning Machine, etc. Finally, multidisciplinary application studies in the field of public procurement of tools and techniques in the legal field, sociology, economics, logistics, etc. will be essential so that, together with the agile & lean management methodologies, the new models towards excellence can be guided.

CONCLUSION

The conceptual review of the most important aspects that define the processes of improvement and transformation of public administration has been proposed. Within these approaches, the main aspects of the transformation and redesign of public acquisition systems have been analysed to make them more effective and efficient, guiding the implementation of a strategic, integrated, and digital management of public procurement.

First, we have analysed the main concepts and trends of the improvement of public administration based on the strategic approach of the New Public Management, its evolution towards the Post-New Public Management, as well as the different strategic approaches that have emerged for its development in recent years.

Second, the feasibility of the proposed improvement needs to address its strategic implementation through the application of lean and agile management techniques, tools, and methodologies. Far from being both incompatible methodologies, they are highly complementary for the improvement of the functioning of organizations. Lean and agile management is simultaneously opposite and complementary. The strategies must be combined with both methodologies, since it is necessary to respond to different needs, low costs (efficient) and rapid response capacity (agile), both of which are extremely valuable for an efficient and effective performance.

Third, it is necessary to make investments and public purchases more effective and efficient, rationalize public spending by avoiding waste and corruption, and implement a new methodology of work and public culture. Consequently, we have to restructure the procurement systems, not only by addressing a process of centralization and inter-institutional cooperation for the exclusive achievement of economies of scale, initiatives that are the obvious corollary of the proposed initiatives, but through a profound conceptual and organizational change, that is, the creation of a new purchasing orientation through the design and implementation of a new systemic model of strategic, integrated and digital purchasing management.

Finally, two of the aspects that can improve acquisition processes can be highlighted and promote a permanent search for excellence through continuous improvement and organizational learning. On the one hand, the integration of procurement with the previous phases of strategic planning, programming, and budgeting is proposed. On the other hand, establish the need to review the organization and pro-

curement procedures of public bodies, whose objective would be to improve the quality of contracting as well as reduce costs.

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Chapter 16
A Study on Deep Learning Methods in the Concept of Digital Industry 4.0

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ABSTRACT

Nowadays, the main features of Industry 4.0 are interpreted to the ability of machines to communicate with each other and with a system, increasing the production efficiency and development of the decision-making mechanisms of robots. In these cases, new analytical algorithms of Industry 4.0 are needed. By using deep learning technologies, various industrial challenging problems in Industry 4.0 can be solved. Deep learning provides algorithms that can give better results on datasets owing to hidden layers. In this chapter, deep learning methods used in Industry 4.0 are examined and explained. In addition, data sets, metrics, methods, and tools used in the previous studies are explained. This study can lead to artificial intelligence studies with high potential to accelerate the implementation of Industry 4.0. Therefore, the authors believe that it will be very useful for researchers and practitioners who want to do research on this topic.

INTRODUCTION

Industry 4.0 is defined as the fourth phase of the industrial revolution. The invention and use of steam engines led to Industry 1.0; the development of electric and batch production devices led to Industry 2.0; the use of robots and computers on production lines led to Industry 3.0, and lastly, the big industrial revolution today named as Industry 4.0 continues to impact our lives. The desire to create super-smart societies and not to make any mistakes will be referred to as Industry 5.0.

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Industry 4.0 is a process that aims to reduce the costs by decreasing the human impact in the production to a minimum through artificial intelligence methods, internet of things (IoT), and big data. The purposes of Industry 4.0 include the transition of traditional factories into digital factories, fast and reliable productions, development of smart cities, creating data storages with instant notifications and obtaining more meaningful knowledge from the data, minimum use of energy, and reducing the environmental damage to a minimum.

Industry 4.0 is classified in multiple categories based on the improvements in the hardware of electronic improvement cards, sensor architectures and structures, cloud services and wireless communication systems, and electronic systems. These categories are; Internet of Things (IoT), Cyber-Physical Systems, Cloud Technology, Augmented Reality, Autonomous Robots, Layered Production, Cyber Security, Big Data and Analysis, System Integration (Süzen & Kayaalp, 2019; Tekin & Karakuş, 2018).

The main characteristics of Industry 4.0 include communication of machines with each other and a system, an increase of production efficiency, and improvement of the mechanisms of robots. These situations are required to use some new analytical algorithms for Industry 4.0. Various industrial challenging problems in Industry 4.0 can be solved by using deep learning-based technologies.

Deep learning is a machine learning method that uses large amounts of data to perform supervised or unsupervised activities including feature extraction, transformation, and categorization through mimicking the skills of observation, analysis, learning, and decision making that human brain uses for complex problems (Süzen & Kayaalp, 2018a). It is a machine learning method developed by expanding traditional neural networks.

Today's industrial environments produce large amounts of regular or irregular data. Processing the data generated with the right methods and strategies would allow for reduced costs, the ability to calculate the life of materials used, easy use of autonomous systems, taking measures for potential mistakes, and efficient energy usage.

This study is to examine and explain the Industry 4.0 concepts and deep learning methods in terms of the methods used, the success of recommended systems, the success of the metrics, and the data libraries used in the related studies in the literature. Therefore, a literature review will be provided with classifications by interpreting the findings of related studies in the field. The study will include the following sections; background on Industry 4.0 and concepts related, deep learning and methods, metrics used to measure the success of deep learning methods, literature review, findings, and discussion.

BACKGROUND

In order to understand the literature review section better, this section will focus on the introduction of Industry 4.0, deep learning and success metrics of the research. The research strategy of the study is also mentioned.

Research Strategies

We have used the SMS (Systematic Mapping Study) method to examine the studies in the literature related to deep learning methods that can be used for Industry 4.0. SMS is a literature review method that aims to classify by interpreting the outputs from the relevant studies to find answers to the research questions identified.

The keywords that were determined for searching in online libraries are "deep learning, industry 4.0". The search was carried out by connecting the two keywords with the "and" conjunction. It was observed that when the searches were connected with the "or" conjunction, quite a lot of publications unrelated to the subject were listed. Searches were made in IEEE Xplore, ScienceDirect, Google Scholar and Wiley online databases and a total of 60 results were found. Publications encountered in online databases are given in Table 1. Within the scope of this study, a total of 27 publications were used after the SMS "inclusion and exclusion criteria" process.

Table 1. Publications encountered by the online database

	Conferences	Journals	Early Access Articles	Magazines	Total
IEEE Xplore	32	11	3	3	49
ScienceDirect	0	3	0	0	3
Google Scholar	3	5	0	0	8
Wiley	0	0	0	0	0
Total	**35**	**19**	**3**	**3**	**60**

Relevant publications have been examined according to criteria such as industry 4.0 domain, deep learning models used, whether traditional machine learning models were used, online data set, success metrics used, year of publication, and type of implementation tool.

Industry 4.0

Industry 4.0 is divided into some subtitles in parallel with the developments in electronic development cards, sensor architectures, and structure, cloud services and wireless communication systems, in the hardware that make up the electronic systems. These are the Internet of Things (IoT), Cyber-Physical Systems, Cloud Technology, Augmented Reality, Autonomous Robots, Layered Production, Cyber Security, Big Data and Analysis, System Integration subheadings (Süzen & Kayaalp, 2019; Tekin & Karakuş, 2018). Some subtopics of Industry 4.0 are described below.

Internet of Things (IoT): Communication between different devices has become easier due to the developments in internet technology, internet protocols, and information processing systems in recent years. These developments, in which billions of devices enter the Internet, have enabled the development of the Internet of Things concept. The purpose of the Internet of Things (IoT) is to develop a smarter environment and a simplified lifestyle by saving time, energy and money (Mahdavinejad et al., 2018).

Autonomous robots: Autonomous robots, also called intelligent robots, are robots that can make desired operations by entering dangerous areas where people will have trouble reaching. They are robotic systems that have the feature of knowing their own positions, can use artificial intelligence techniques thanks to the embedded systems they contain, can produce results according to the information they receive from the external environment with the help of sensors, and can take decisions according to the result (Akyol & Uçar, 2019; Süzen & Kayaalp, 2019). Autonomous robots also have the ability to work together as a herd and collect data.

Augmented Reality: A combination of virtual and real-world created by combining and enriching the real environment with virtual objects (Doğan, Sönmez, & Cankül, 2020). Augmented reality is the 3D positioning of a camera, computer, and practical world elements; enrichment of real-world spaces and objects by producing virtual items in the computer environment (Tekin & Karakuş, 2018). Augmented reality applications, a new method in human-computer interaction, are frequently encountered in the field of education, in the field of medicine (Joda, Gallucci, Wismeijer, & Zitzmann, 2019), in the areas of games and sports.

Big data: Over the years, regular or irregular data sets are accumulated that consist of content such as companies in the business world, social network users, articles gathered by authors on blogs opened on the internet, video & photography produced by content producers (Aktan, 2018; Tekin & Karakuş, 2018). The process of producing meaningful and useful information as a result of some methods from these datasets is called big data.

Deep Learning

Machine learning can be used in processes such as content filtering in web searches and social networks, deciding suggestions on e-commerce websites, identifying objects, converting speech to text, matching news content, publications or products with users' interests and showing matched results. Such practices can also be done with deep learning techniques recently (Lecun, Bengio, & Hinton, 2015). Deep learning is a machine learning technique that mimics the abilities of the human brain such as observation, analysis, learning, and decision making for complex problems, and can perform operations such as supervised or unsupervised features such as feature extraction, transforming and classifying using large amounts of data (Süzen & Kayaalp, 2018b). In its simplest form, deep learning is a machine learning technique created by expanding traditional neural networks.

Depending on the type of the problem and the data set, the deep learning methods to be applied also differ. Some of these are convolutional neural networks, recurrent neural networks, long-short term memory networks, restricted Boltzmann machines, deep autoencoders (Pekmezci, 2012; Süzen & Kayaalp, 2018b).

Convolutional neural networks (CNN): They are often used with image datasets. It is an algorithm that can distinguish objects by clustering the objects on the given image. Some filters are applied to recognize objects on images and detection of objects on the image is provided.

Recurrent neural network (RNN): In traditional artificial neural networks, all inputs and outputs are independent of each other. The recurrent neural network is an artificial neural network model in which the output from the previous step is given as an input to the current step. Recurrent neural networks can be used as working logic as single input-single output, single input-multiple output, multiple input-single outputs, multi-row input-multi-row output and multi-synchronous input-multi-synchronous output(Eşref, 2019; Süzen & Kayaalp, 2018a).

The long short-term memory (LSTM): It is a deep learning algorithm that reduces the error flow of recurrent neural networks. It determines how much of the input data should be forgotten, thanks to Sigmoid and forget gates(Graves & Schmidhuber, 2005).

Restricted Boltzmann machines (RBM): Limited Boltzmann Machines is a random neural network that can learn probability distribution on the input set. It consists of the first two layers (Sertkaya, 2018). The first layer is called the visible or input layer, and the second layer is called the hidden layer. Nodes in the hidden layer are where calculations are made for output.

Deep auto-encoders: It is a deep learning algorithm consisting of three layers that produces the data as output, which they receive as input. It is used to convert an N-dimensional vector into a smaller-sized vector with little loss. They are not used for the classification process. They can be used for data compression and feature extraction processes (Süzen & Kayaalp, 2018a).

Measurement of Model Success (Success Metrics)

It is required to measure whether the prepared models are more successful than or lag behind similar studies. The methods used for this are called metrics. The metrics encountered as a result of the literature research conducted within the scope of this study are mentioned in this section. Some metrics applied in machine learning or deep learning algorithms are given and explained below.

1. Classification Accuracy
2. Logarithmic Loss
3. Confusion Matrix
4. F1 Score
5. The area under Curve- ROC Curve
6. Mean Absolute Error
7. Mean Squared Error
8. Root Mean Squared Error

Classification Accuracy: It is the ratio of the number of correct estimates to the input sample. It is seen that it does not work efficiently in unbalanced data sets. It gives a percentage result. The accuracy rate is shown in Formula 1.

$$Accuracy\ Rate = \frac{Number\ of\ correct\ estimates}{Number\ of\ total\ estimates\ made} \tag{1}$$

Logarithmic Loss - Log Loss: It is an evaluation criterion that works with the method of punishing false estimates. It works well for multi-class classifiers. It determines the probability that the estimate belongs to each class. The logarithmic loss range is between [0, ∞]. Formula 2 shows a logarithmic loss.

$$Log\ Loss = \frac{-1}{N}\sum_{i=1}^{N}\sum_{j=1}^{M} yij * \log\left(Pij\right) \tag{2}$$

Confusion Matrix: Also called the confusion matrix or error matrix, this metric gives a matrix as a result to understand the full performance of the model. There are 4 important terms for this metric. These are;

- True Positive: the situations we estimated as “yes” and the real output is “yes”.
- True Negatives: the situations we estimated as “no” and the real output is “no”.
- False Positives: the situations we estimated as “yes” and the real output is “no”.

- False Negatives: the situations we estimated as “no” and the real output is “yes”. When these situations are evaluated, a matrix structure is created, as shown in Table 2.

Table 2. Confusion matrix table

		Predicted	
		Positive	**Negative**
Actual	Positive	True Positive (TP)	False Negative (FN)
	Negative	False Positive (FP)	True Negative (TN)

Success criteria such as Accuracy, Error rate, Precision, Recall, F1-Score and MCC are found by using this table (Bulut, 2016). The formula for the accuracy metric is given in Formula 3, the calculation of the error rate metric is given in Formula 4, the formula for the precision metric is given in Formula 5, the formula for the Recall metric is given in Formula 6 (Coşkun & Baykal, 2011).

$$Accuracy = \frac{TP + TN}{Total\,Sample} \tag{3}$$

$$Error\,rate = \frac{FP + FN}{Total\,Sample} \tag{4}$$

$$Precision = \frac{TP}{TP + FP} \tag{5}$$

$$Recall = \frac{TP}{TP + FN} \tag{6}$$

F1 Score: This metric, also called the F1 score, is used to measure the accuracy of a model. The F1 score range is between [0-1]. It is the harmonic average of precision, recall performance evaluation criteria. It allows evaluating both criteria together. In Formula 7, the calculation formula of the performance of the F1 score is given.

$$F_1 = \frac{2 * precision * recall}{precision + recall} \tag{7}$$

Area Under Curve-AUC and Receiver Operating Characteristic Curve-ROC: The area under the curve is used for the binary classification problem. AUC scale is used to characterize the overall performance of a classification solution.

True Positive Rate (Sensitivity) (TPR): True Positive Rate is defined as TP / (FN + TP). True Positive Rate corresponds to the ratio of positive data points that are considered positive relative to all positive data points.

False Positive Rate (Specificity) (FPR): False Positive Rate is defined as FP / (FP + TN). False Positive Rate corresponds to the rate of negative data points that are mistakenly considered positive compared to all negative data points.

By placing these two metrics on the TPR and FPR x and y axes, the calculation of the area under the line is AUC.

Mean Absolute Error -MAE: The mean absolute error is the average of the difference between the actual values and the predicted values. It measures how far the estimates are from the original output. However, they do not give us any idea about the direction of the error, i.e. whether we anticipate the data or overestimate the data. Mathematical representation of the mean absolute error is given in Formula 8.

$$\text{Mean Absolute Error} = \frac{1}{N}\sum_{j=1}^{N}\left|yj - \widehat{yj}\right| \tag{8}$$

Mean Squared Error-MSE is very similar to the Mean absolute error; the only difference is that the MSE averages the square of the difference between the original values and the predicted values. The advantage of MSE is that it is easier to calculate the gradient, whereas Mean Absolute Error requires complex linear programming tools to calculate the gradient. Because we've resolved the error, the effect of larger errors becomes more distinct and gets caught by smaller errors, so the model can now focus on larger errors. MSE formula is given in Formula 9.

$$\text{Mean Squared Error} = \frac{1}{N}\sum_{j=1}^{N}\left(yi - \widehat{yi}\right)^2 \tag{9}$$

Root Mean Squared Error (RMSE) is a quadratic scoring rule that measures the mean error size. RMSE is the most popular evaluation criterion used in regression problems. The difference between the estimate and the observed values is taken on each square and then centered on the sample. Both evaluation tools can be used together to diagnose variations of errors in a series of estimates. RMSE will always be greater than or equal to MAE. The bigger difference between them is that the variance of individual errors in the sample is larger (Aydın, 2018). RMSE formula is given in Formula 10.

$$RMSE = \sqrt{\frac{\sum_{i=1}^{n}\left(P_i - O_i\right)^2}{n}} \tag{10}$$

Except for the above - mentioned performance metrics, there are other metrics used. Gain and Lift Charts, Kolmogorov Smirnov Chart, Gini Coefficient, Concordant - Discordant Ratio are some of these.

LITERATURE REVIEW

In a study by Maggipinto, (2018) et al., a deep learning-based system was developed in the production environment to reduce costs and increase efficiency by providing production optimization. This system has been run on a real industrial dataset. This data set contains optical emission spectroscopy data. The reason for choosing deep learning algorithms in this study was that the feature extraction process for the developed model could be done by the system. Since the data set consists of visual data, CNN and FNN (Feedforward Neural Networks) were used to create this model. The success of the designed system was measured with MSE, R2 and MAE metrics. The deep Convolutional Neural Network used enables efficient use of plasma OES (Optical Emission Spectroscopy) data without requiring a precise feature extraction. Keras and TensorFlow libraries were used to develop the model.

In a study conducted by Yu, (2019) et al., a study was conducted to estimate the remaining usage times of the devices by making use of the sensor data produced by the devices used in the field of health. C-MAPSS (https://data.nasa.gov/widgets/xaut-bemq), which is an open-source data set, was used for this study. CNN, due to its feature extraction ability, and LSTM deep learning algorithms due to time series operations, were used in this study, which deals with smart manufacturing, cyber-physical systems and big data systems, which are among the concepts of Industry 4.0. The data obtained as a result of the CNN-LSTM combined model was compared with the traditional machine learning model data created from another publication. The reason why the designed system works well is that it is said that the data collected in the real environment cause different distributions between the training set and the test set due to the disturbances in the working environment. This affects generalization in traditional machine learning models. RMSE metric was used to measure the performance of this study.

The study by Yue, (2018) et al. proposes an end-to-end method based on deep learning and transfer learning for industrial fault diagnosis. Industrial data are time series with multiple features collected from different sensors, and an excellent feature presentation is crucial for accurate results. CNN-LSTM combined model combined with CNN deep learning algorithms due to feature extraction ability and LSTM due to time series operations were used. The model created on the data set with the blade icing problem in wind turbines was applied, and some good results were obtained. The model created was compared with LR (Logistic Regression), SVM (Support Vector Machine), 1, 2 and 3-layer LSTM, 1, 2 and 3-layer CNN and CNN-SVM / RNN / GRU models, and it was reported to give the best results with 0.9465 accuracy. These model evaluation criteria are accuracy, RMSE and the score calculated by the score function in the competition description that reflects the precision and recall.

In the study conducted by Pillai (2018) et al., an effort was made in Industry 4.0 factories to reduce the estimated production cost and waste of product quality. Due to the unbalanced behavior of traditional machine learning methods for quality prediction, the proposed new model has recommended a framework that combines the feature extraction capabilities of CNN and the field information features of fuzzy systems. It has been observed that there is progress compared to existing methods. The success of the system was measured with G-Mean, ROC-AUC, MCC, F1-score. In this study, adult dataset (https://archive.ics.uci.edu/ml/index.php) and semiconductor industry dataset, which are accessible to everyone, are used.

In a study conducted by Bodkhe (2019) et al., a system called *Blockchain Effective Intelligent Tourism and Accommodation Management* (BloHosT) is proposed. BloHosT is a system that comes with Industry 4.0 and proposes the collection of digital payments that are increasing day by day under one roof. Through the LSTM deep learning algorithm, experiences are obtained from the comments made

by tourists about the places they have visited before. Since LSTM has many hidden layers, it has the ability to extract different features from the data. The data set has been trained with LSTM classifiers to create rating points. These experiences are produced for BloHosT. It is stated that BloHosT has a high return on investment compared to traditional methods in the tourism sector.

The study conducted by Miškuf and Zolotová (2016) focused on Industrial systems, cloud architecture and data analytics, which will be the main pillars of Industry 4.0. Using the UCI repository datasets (https://archive.ics.uci.edu/ml/index.php), H20 and Microsoft Azure (MA) service for deep learning were compared. The classification was made on the selected data set, and accuracy, sensitivity and MSE values were calculated with the help of complexity matrix. This comparison process is among some traditional methods (Neural Network, Decision Forest, Decision Jungle, Logistic Regression, SVM) using H20 deep learning and MA services. In experiments with H20 deep learning, it was observed that the accuracy was higher, and the error rate was lower. It is emphasized in the study that such cloud services will play a more prominent role in future data analytics.

In a study by Vafeiadis (2019) et al., a data analysis platform for less waste was presented from the data obtained by a waste management company through sensors. The platform, created using the Internet of Things devices, aims to provide intelligent solutions to the waste management company that will provide planning support, ease of monitoring and managing processes. A web-based tool has been developed for the platform. Deep learning algorithms are used in the price estimation of products such as paper, metal, plastic, etc., which are materials in waste management. LSTM, which is one of the deep learning algorithms, has been used since price prediction is difficult in the machine learning algorithm. The data of the related company for 2016-2018 has been a data set for the price estimation of the developed tool.

In a study by Hao (2019) et al., an artificial intelligence model called *Privacy Enhanced Federated Learning (PEFL)* was proposed to solve various industrial challenging problems in Industry 4.0. PEFL was created with a federated learning approach that allows the system to be learned in collaboration with different participants without disclosing the local data obtained. IoT devices collect and encrypt encrypted data via a cloud server. Systems such as Microsoft Azure Machine Learning, Google Cloud ML Engine have been proposed for cloud service. MNIST (http://yann.lecun.com/exdb/mnist/) data set was used to test the proposed system, and performance evaluation was done with CNN. The accuracy rate of the system, which was designed with a collision rate of 0.05 to 0.1, was shown as 95.7% and 95.5%. It is stated that the collision rate has a bad result above 0.5. It is stated that studies will be carried out with more massive data sets in future studies. It is also emphasized that it provides data privacy since it is a federated learning-based system.

In a study by Calderisi (2019) and colleagues, an approach that combines different networks and techniques has been proposed to detect defects that occur during weaving on a fabric. This study consists of 71878 images taken with high-resolution vision systems. In the study, 3 different deep learning approaches were used. First, the system was created with CNN. The second is the combination of CNN and feed-forward neural network (CNN + META). In the third, variable influence on projection (VIP) value is taken as <1. The success of the system was measured with Classification Accuracy. These approaches have been tested in Kode, mobeNet, inception, resNet and denseNet models.

Another study involving the concept of augmented reality and the Internet of Things, which are components of Industry 4.0 for smart factories, has been conducted by Subakti and Jiang (2018). Mobile augmented reality system design has been designed to quickly visualize and interact with the machines used in smart factories. Through the received images, the image classification library mobileNets and TensorFlow, industrial machine parts are marked on the screen of the mobile device. For this, a cloud

SCADA server was used. This process used CNN because of its success in mobile classification and image classification. The data set used for this study relates to a Wire Electrical Discharge Machine (WEDM) located in a mechanical workshop at National Central University.

Zabiński (2019) et al. mentioned the idea of applying prototype industrial platform computational intelligence methods for condition monitoring in Industry 4.0 production systems. As an example, CNC milling set head mechanical imbalance prediction system developed with the use of deep learning is explained. The model was built with CNN, and 99.8% success was achieved.

In the study conducted by Yan (2018) et al., an algorithm based on deep-compensating auto-coder (DDA) and regression operant have been proposed to estimate the remaining life of industrial equipment. The proposed system consists of 2 DAA architectures and linear regression analysis. The error between the system estimated and the actual value is about 20%. It has been stated that Industry 4.0 demonstrates its applicability to speed up implementation. Caffe was used for the training of the developed model. It is stated that the proposed concept and algorithm combines the typical industrial scenario and high artificial intelligence with the potential to accelerate the implementation of Industry 4.0.

A study by Duan (2019) et al. is on smart device monitoring systems, one of the benefits of Industry 4.0. In this study, it is suggested to determine the internal thermal failure of the transformer with CNN. The transformer, which monitors temperature and speed images under error conditions, was simulated using the lattice Boltzmann Method (LBM) and feature extraction was made on the images. There is insufficient data because the transformers are not damaged frequently. This problem was tried to be solved by transfer learning. Then, image segmentation was performed to extract the features of the error fields and to simplify the data volumes. CNN was used to make recurrent error localization. After the image segmentation, the accuracy was calculated using the information obtained by the sensors, the mean error localization accuracy decreased from 97.95% to 94.42%, while the data volume was reported to decrease to almost 1% of the original. It was stated that the average calculation time decreased by 8.816% and the loss value decreased by 37.68%. Architecture has been tried in different neural networks and it has been stated that the best performance value has been reached by using GoogLeNet.

In a study by Saravanan (2019) et al., an indoor interactive robot was designed using the Internet of Things, CNN and Q-learning. This robot designed with IoT features, is built on having an arm that can reach the desired target and perform the appropriate action in the indoor environment. To facilitate navigation in a space, a minimum number of grid matches (4x4) were made and it was aimed to learn how to go to the desired object in the most appropriate way. CNN is used for object detection. The created models are sent to Raspberry Pi, which acts as fog node in industry 4.0 environments. Testing and development processes were done here. Values such as temperature, humidity read by the robot can be transmitted to Ericsson's IOT Accelerator platform and indoor plant monitoring system can be realized. The movement of the robot was carried out with Q-learning, reinforcement learning (RL) and CNN. The success of the system has been examined in three different cases; (i) 100% when only RL is used, (ii) 50% when only CNN is used, and (iii) 50% when both CNN and RL are used. Keras library was used to conduct this study.

In a study by Richter (2017) et al., it was stated that not only data were produced by industry 4.0, but also a large amount of data was started to be stored, and this data has the potential to help develop the control machines. Instead of manual control of printed circuit boards (PCBs) on all production lines, today, automatic optical inspection (AOI) is used. In this study, an architectural structure integrated with deep learning techniques is proposed to AOI manufacturers. It has been stated that surface mounted devices can be preferred due to their success in feature extraction of deep convolutional neural networks,

although there are studies with traditional machine learning approaches to find defects in wipe joints. It has been stated that the data set required for the training and testing of the developed system can be obtained from the devices coming to the repair stations and the better the data received from the devices of different brands, the better the proposed architecture can give results. It was stated in the study that the model proposed in the future is to make the first version. It is stated that the proposed AOI system can use deep convolutional neural networks (CNN) to simplify the optical inspection process. It is stated that tools such as tensorflow, theano, caffee, which have become widespread in recent years, can be selected for the implementation of the system. It is stated that a huge data set is needed to realize such a system. It is stated that there is no such database for now and it is necessary to work for it. A new system has been proposed for AOI, which is included in the Industry 4.0 concept, and it has been stated that it will be developed.

A study by Tsai and Chang (2018) focused on a deep learning-based application of the coil level adjustment system used in sheet metal production/shaping. An automated encoder neural network was used to implement this system, which was recommended for smart manufacturing. The developed model was first evaluated with 200 samples, but when it was observed that it did not work well, it was increased to 500 samples. It has been increased to 700 samples for the system to reach a stable state. The system has achieved 80% success. It is stated that future studies will be to try different deep learning methods to compare similar applications and improve the current solution.

In a study by Ferrari (2019) et al., performance evaluation of full-cloud and edge-cloud architectures for the determination of anomaly based on deep learning in the concept of the Internet of objects, which is one of Industry 4.0 concepts, was performed. LSTM is used in architecture as it is suitable for the online time series anomaly approach. LSTM is a deep learning algorithm that can represent the relationship between current events and previous events and addresses time-series events. Siemens controller and Microsoft Azure platform cloud systems are also used in system architecture. It has been shown that full-cloud architecture can outperform edge-cloud architecture.

Collaborative production ecosystems provide a high amount of data collected from factories and generally related to machine data, sensor measurements and production processes. In a study by Nizamis (2018) et al., it was explained how these data are modeled and stored using ontologies, how deep learning tools are obtained and analyzed by continuous learning algorithms, and ultimately how they are returned to the semantic framework and how they increase the efficiency of a semantic mapper respectively. The purpose of using deep learning tools is to imitate prices for raw material needs and therefore provide sustainable estimates for raw materials. RNN and LSTM are used. The system has been tested with the data obtained from London metal exchange including 1400 price samples selected from 2012-2017 (https://www.quandl.com/data/LME-London-Metal-Exchange). Mean Squared Error was used to measure the performance of the system.

One of the important components in the realization of Industry 4.0 is unmanned aerial vehicles. In a study by Li (2019) et al., a system was developed that simultaneously counts and detects vehicles from images from unmanned aerial vehicles. CNN is used for this system; feature extraction layer and object count layer are created. CARPK data set (http://web.inf.ufpr.br/vri/databases/parking-lot-database/), VisDrone2018 data set (http://www.aiskyeye.com) and UAVDT were used with almost 90000 tools for training of this system. The applied methods were tested with RMS and RMSE. MatConvNet was used to implement the system.

In a study by Siddiqui (2019) et al., a new model is presented for determining evolutionary deep learning models for time series analysis. The B5M data set in the internet traffic data set (Cortez, Rio,

Rocha, & Sousa, 2012) was used for the training and testing of this model. CNN, one of the deep learning methods, was used to create the model, and keras and tensorflow were used for its realization. MSE metric was used for the evaluation of the success of the model. The proposed model has been found to achieve 99.88% success. The developed system is published with open access (https://github.com/shoaibahmed/TSViz-Core).

A system for early error detection in the steel industry has been proposed by Karagiorgou et al., (2019) et al. Produced from sensor data using deep learning techniques, this model offers some early results on modeling and predicting the complex and dynamic behavior in the manufacturing environment, one of the indispensable concepts of Industry 4.0. This system consists of a perception module, detection module and prediction module. LSTM was used to model the dynamic structure of manufacturing systems. The reason why LSTM is preferred is that it is successful in collecting the information of the sequential data and predicting the future ones. The success of the system was measured by RMSE and MAE metrics. It was stated that the results were promising. The sampling frequency was obtained from 3 sensors with 0.2 Hz (1 reading in 10 seconds). Acceleration, speed and maximum amplitude measurement were obtained by creating the information for 1 month. Creating a dataset from sensor data is also associated with the IoT concept.

In a study by Tsutsui and Matsuzawa (2019) the Virtual Metrology Model, which performs Optical emission spectroscopy (OES) data with deep learning methods, is proposed. In this study, real data were studied, and CNN was used. The proposed system (OESNet) has been compared with AlexNet, ZFNet, GoogLeNet, ResNet and SENet and it has been stated that it gives successful results. R-Squared value and sMAPE are used as comparison metrics.

In a study by Chen and Guhl (2018), object learning based on deep learning and industrial robot control design was mentioned. This robot allows the UR5 to detect, find and interact with different objects such as tools and office supplies. Using a stereo view camera, it is possible to obtain both RGB and depth data of the surrounding robots and work area. This data is fed into the Faster-RCNN Network than deep learning algorithms to realize the recognition and localization of existing objects from 50 different classes. Appropriate operations can be planned and implemented with the information obtained. The model has been successfully trained and has been able to recognize and find with 68% accuracy.

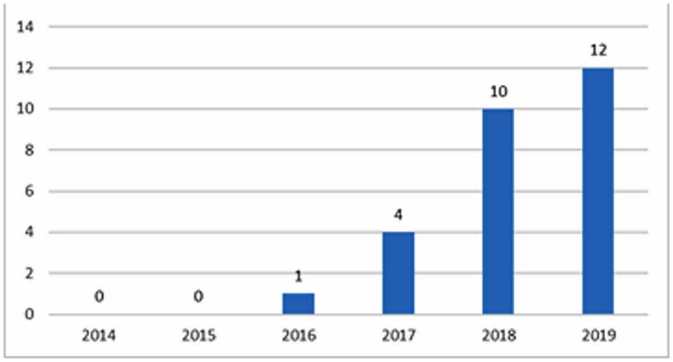
Industry 4.0 and deep learning have also been the subject of research/review/compilation studies. The structures involving the problems faced by intelligent production lines such as collecting big industrial data obtained from smart factories, modeling smart product groups based on ontology, forecasting diagnostics, and prediction methods based on the deep neural network were examined. It is stated that one of the topics suggested to deal with these problems is deep learning and deep neural network (Xu & Hua, 2017). Another research study explores the latest technology available to automate, strengthen and combine systems used in industry 4.0 concepts, such as smart cities, autonomous vehicles, and energy efficiency, in smart manufacturing and healthcare. Although these systems apply big data and deep learning areas, they focus on the areas that are missing (McKee, Clement, Almutairi, & Xu, 2018). In a study by Liu (2017) et al., it was stated that Industry 4.0, Industrial Internet, unmanned aerial vehicles, smart driving, 3D printing are only products obtained from the development and budding of the motor nervous system of the Internet. The relationship between artificial intelligence and the internet has been examined in terms of brain science. The creation of a new artificial intelligence system model with the Internet and brain science was discussed.

SOLUTIONS AND RECOMMENDATIONS

In this study, it has been investigated how much deep learning and deep learning methods are used in industry 4.0 concept. The evaluation metrics of deep learning methods, datasets and sub-concepts of Industry 4.0 are also included in the evaluation criteria. It was observed that no data was specified for the classification created in some publications.

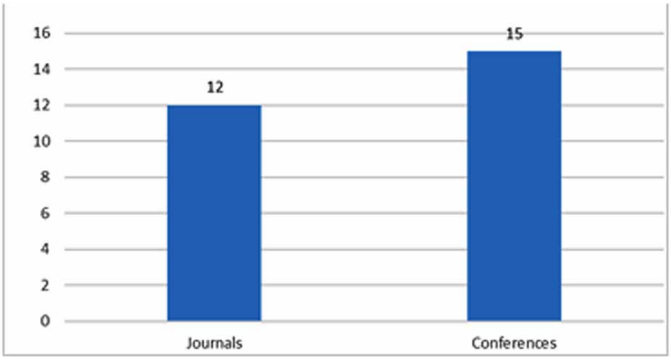
As a result of the literature research, the existence of deep learning practices was found in the Industry 4.0 concept. Although these two concepts have entered our lives in recent years, they have become very popular. However, the findings show that it is not at the desired level. The graphic of the publication of the relevant studies by years is given in Figure 1. According to the graphic, it has been observed that new studies have been carried out within the industry 4.0 concept with deep learning methods. The fact that the first publication was made in 2016 and the increase in publications in other years shows that the research area may still be more popular in the coming years.

Figure 1. Number of publications by year in the related field



When evaluated according to the type of publication, the graphic of the publication of the relevant studies according to the publication types is given in Figure 2. It is seen that the related publications are mostly the conference publications. However, there are publications published as original articles. In 12 original articles, 2 different articles are studies that suggest a concept, not an experimental study on these fields. It gives ideas on what can be done thanks to deep learning methods in Industry 4.0. Some experimental studies are presented in Table 3 as conference papers. Some publications are presented in Table 3 as the original articles. Original articles mostly consist of industry 4.0 subfields, production, manufacturing and big data. It is observed that CNN is the most used one among the deep learning methods.

Figure 2. Publication types



When the literature study was evaluated according to regions, it shows that there were no publications from Turkey. It has been observed that the studies related to the relevant field were conducted mostly in China.

Evaluation by Industry 4.0 areas: Industry 4.0 concept is divided into 9 main areas in total and publications are classified under these 9 main areas. These areas were determined as manufacturing, big data, internet of things (IoT), machine-machine interaction-automated tools- (MTM), cyber-physical systems, cloud systems, augmented reality, process control, security.

Distribution of publications according to Industry 4.0 fields is given in Table 3. The most studies were conducted on manufacturing, big data and the internet of things. Some publications are publications containing more than one industry 4.0 field. As Industry 4.0 requires smart factories, positive use of accumulated data and machine interaction it is natural to work in these areas. That these systems will lead to efficiency and change in many different sectors.

Deep learning is basically divided into 5 main methods and subclasses are created according to the use of these methods. These methods are CNN, RNN, LSTM, Auto encoder, and Boltzmann method (LBM). CNN is the most used method among related studies. It is stated that CNN is successful in feature extracting and classifying operations on pictures. Deep learning methods used are shown in Table 4. The LSTM method is another preferred method. It is stated that LSTM is preferred due to its success in time series operations and having many hidden layers.

Studies that use LSTM and CNN in combination are also seen (Yu, Wu, Zhu, & Pecht, 2019; Yue, Ping, & Lanxin, 2018). It is seen that CNN and hybrid algorithms are used on visual images and LSTM is used in the evaluation of sensor data. It has been seen that LSTM is used for estimation processes and CNN + LSTM is used together to determine the remaining lifetimes of the devices.

It was observed that open-source deep learning libraries and cloud computing methods were used in the development of deep learning applications. In some studies, data sets were created for the study but it was seen that they were not shared. In some studies, it was observed that more than one tool was used. It was observed that the most used tools are tensorflow and keras, and Microsoft Azure, GoogleNet, H2O machine learning is used for cloud computing (Table 4).

Only the data set used in 7 of the studies was specified. you can see these studies in Table 5. Some studies have worked on the data they produce, and the data set has not been shared with the reader. It can be seen that some studies can be done about this field using shared data sets.

Table 3. Industry 4.0 field of publications

Study	Years	Publication Type	Industry 4.0 Field(s)
(Maggipinto, et al. 2018)	2018	Journals	Manufacturing
(Yu etal., 2019)	2019	Conferences	Manufacturing, Cyber-physical systems, Big data
(Yue et al., 2018)	2018	Conferences	Manufacturing
(Pillai et al., 2018)	2018	Conferences	Manufacturing, Big data, Process control
(Bodkhe et al., 2019)	2019	Conferences	Cloud system, Big data
(Miškuf & Zolotová, 2016)	2016	Conferences	Big data
(Vafeiadis et al., 2019)	2019	Conferences	IoT, Big data, MTM
(Hao et al., 2019)	2019	Journals	IoT, Big data, Atifial intellice
(Calderisi et al., 2019)	2019	Conferences	Manufacturing,
(Subakti & Jiang, 2018)	2019	Conferences	IoT, Big data, Augmented reality, Manufacturing
(Xu & Hua, 2017)	2017	Journals	Big data, Manufacturing, Cyber-physical systems
(Yan et al., 2018)	2018	Journals	Big data, Manufacturing, Cyber-physical systems
(Duan et al., 2019)	2019	Journals	Security
(Saravanan et al., 2019)	2019	Conferences	IoT
(Richter et al., 2017)	2017	Conferences	Manufacturing
(Tsai & Chang, 2018)	2018	Conferences	Manufacturing
(Ferrari et al., 2019)	2019	Conferences	IOT, Cloud system
(Nizamis et al., 2018)	2018	Conferences	Manufacturing
(Li et al., 2019)	2019	Journals	MTM
(McKee et al., 2018)	2018	Journals	Cyber-physical systems, IoT
(Siddiqui et al., 2019)	2019	Journals	MTM
(Karagiorgou et al., 2019)	2019	Conferences	IoT, Manufacturing
(Alenazi, Niu, Wang, & Savolainen, 2018)	2018	Conferences	Cyber-physical systems
(Tsutsui & Matsuzawa, 2019)	2019	Journals	Manufacturing
(Liu et al., 2017)	2017	Journals	IoT, Big data
(Chen & Guhl, 2018)	2018	Journals	MTM
(Zabiński et al., 2019)	2019	Journals	Manufacturing

Table 4. Deep learning methods, tools and metrics used in the studies

Study	Years	Tool(s)	Deep Learning Method(s)	Metric(s)
(Maggipinto et al., 2018)	2018	Keras, Tensorflow	CNN	MSE, R2, MAE
(Yu et al., 2019)	2019	-	CNN-LSTM (combination)	RMSE
(Yue et al., 2018)	2018	-	CNN-LSTM (combination)	RMSE
(Pillai et al., 2018)	2018	-	CNN	G-Mean, ROC-AUC MCC, F1-score
(Bodkhe et al., 2019)	2019		LSTM	
(Miškuf & Zolotová, 2016)	2016	H20, Microsoft Azure	-	MSE
(Vafeiadis et al., 2019)	2019	-	LSTM	-
(Hao et al., 2019)	2019	-	CNN	-
(Calderisi et al., 2019)	2019	-	CNN	Classification Accuracy
(Subakti & Jiang, 2018)	2018	Tensorflow	CNN	
(Zabiński et al., 2019)	2019	-	CNN	-
(Yan et al., 2018)	2018	Caffe	AUTO ENCODER	
(Duan et al., 2019)	2019	GoogLeNet	-	Accuracy
(Saravanan et al., 2019)	2019	Keras	CNN	-
(Richter et al., 2017)	2017	Tensorflow, Theano, caffee (offer)	CNN	-
(Ferrari et al., 2019)	2019	Microsoft Azure platform	LSTM	-
(Nizamis et al., 2018)	2018	-	RNN, LSTM	MSE
(Li et al., 2019)	2019	MatConvNet	CNN	RMS, RMSE
(Siddiqui et al., 2019)	2019	Keras, tensorflow	-	MSE
(Karagiorgou et al., 2019)	2019	-	LSTM	RMSE, MAE
(Tsutsui & Matsuzawa, 2019)	2019	-	CNN	R2, sMAP
(Chen & Guhl, 2018)	2019	-	Faster-RCNN	-

Considering the success metrics used in the studies, it has been seen that metrics such as RMSE, MAE, sMAPE, R-Squared are used more than others.

FUTURE RESEARCH DIRECTIONS

This section introduces some useful, practical and theoretical suggestions for potential research fields to researchers. This literature study showed that the application of deep learning methods in the field of industry 4.0 is quite a new subject. Studies on this field will remain popular for a while.

Table 5. Databases used in the studies

Study	Years	Database(s)
(Yu et al., 2019)	2019	C-MAPSS (https://data.nasa.gov/widgets/xaut-bemq)
(Pillai et al., 2018)	2018	https://archive.ics.uci.edu/ml/index.php
(Miškuf & Zolotová, 2016)	2016	https://archive.ics.uci.edu/ml/index.php
(Hao et al., 2019)	2019	http://yann.lecun.com/exdb/mnist/
(Nizamis et al., 2018)	2018	https://www.quandl.com/data/LME-London-Metal-Exchange
(Li et al., 2019)	2019	CARPK dataset: (http://web.inf.ufpr.br/vri/databases/parking-lot-database/), VisDrone2018 dataset: (http://www.aiskyeye.com)
(Siddiqui et al., 2019)	2019	(Cortez et al., 2012)

In general, it is seen that the metrics used in machine learning are used in studies in this field. But it was not encountered much, which shows that it can be used in future studies.

Datasets used in only 7 of the publications were shared. When these datasets are analyzed, it is seen that new studies can be done by using industry 4.0 data with different metrics and methods.

When the realization tools used are examined, it is seen that they are used in cloud systems together with tensorflow and keras tools. Since real-time applications are needed in Industry 4.0, it is seen that more research can be done on cloud computing methods.

Most of the studies conducted a comparison between classical machine learning methods and deep learning methods.

It was seen that much work has been done on the remaining lifetime. It has been seen that this kind of work can be done for many devices.

In some studies, it is thought that data sets cannot be shared due to data privacy. Therefore, studies can be conducted on federated learning approaches for being able to share outputs of models without sharing data on Industry 4.0 concepts.

CONCLUSION

This section reviews the articles using deep learning approaches and reviews the Industry 4.0 and Industry 4.0 field in a comprehensive way. These studies have grouped objectives such as industry 4.0 field, deep learning methods, metrics used, databases. The literature study conducted also guided other studies in this area.

It has been observed that the development of decision-making systems required in smart production and manufacturing environments, the communication of the devices, and the calculation of the remaining lifetimes of the devices are facilitated through deep learning methods.

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KEY TERMS AND DEFINITIONS

CNN: Convolutional neural network is a sub-branch of deep learning and is often used to analyze visual information.

Deep Learning: Deep learning is an artificial neural network technique with hidden layers.

Industry 4.0: Industry 4.0 is the subset of the fourth industry-related industrial revolution. It covers all smart systems.

IoT: The internet of things is to equip devices with the ability to transfer data to each other over a network.

LSTM: The long short-term memory is an artificial repetitive neural network architecture used in deep learning.

Metrics: Metrics are the scales used to evaluate and compare of a performance system.

RNN: Recurrent neural network is a class of artificial neural networks in which the connections between the nodes form a guided graphic across a temporary array.

SMS: Systematic mapping studies provide an overview of a research area, and identify the quantity and type of research and results available within it.

SVM: Support vector machine can be defined as a vector space-based machine learning method that finds a decision boundary between two classes that are farthest from any point in the training data.

Chapter 17
Management and Strategies for Digital Enterprise Transformation, E-Government, and Digital Divide

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ABSTRACT

e-Government (e-Gov) involves the use of information and communication technologies (ICTs) to achieve political goals. Innovative ICTs should be integrated in e-Gov and e-business services to maximize their potentialities/efficiency and to reduce costs. Currently, diverse conceptual models of e-Gov are purposed. These models are applied to understand and optimize governance processes. Globally, it is possible to identify a gap between e-Govs and digital enterprise transformation of developed and developing countries. Digital divisions are closely related to a gap between citizens, families, and businesses regarding the access to ICT and internet in different regions. Are the international recommendations on e-government, digital division and management, and strategies for digital enterprise transformation producing successful outputs? This study aims (1) to describe and analyze international recommendations on e-government, digital division and management, and strategies for digital enterprise transformation and (2) to present practical cases.

INTRODUCTION

The present study is dedicated to the following research question: "Are the international recommendations on e-government, Digital Division and Management and Strategies for Digital Enterprise Transformation producing successful outputs?"

e-Government (e-Gov) involves the use of information and communication technologies (ICTs) to achieve political goals and to ensure an efficient functioning of Public Administrations (OECD, 2019a;

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United Nations, 2020a). Public Administrations will be "open by default" and "digital by design" according to Organization for Economic Cooperation and Development (OCDE) (OCDE, 2018a). Thus, innovative ICTs should be properly integrated in digital governments to maximize their potentialities (Bannister & Connolly, 2020; European Commission, 2016a). Globally, it is possible to identify a gap between e-Govs and Digital Enterprise Transformation (e.g. e-commerce) between developed and developing countries. In this sense, digital divisions are closely related to a gap between citizens, families and businesses regarding the access to ICT and internet in different geographical areas (OCDE, 2006; United Nations, 2018a; Yera et al., 2020). In addition, almost all business integrates digital technologies due to a transition from the *Industrial Era* to the *Digital Era,* with business digitization/digital transformation and technologies contributing for improving companies results (Institute for Digital Transformation, 2017; Martínez-Caro et al., 2020). Consequently, defining policies and plans for maintaining and optimizing digital resources is required to maintain digital enterprises (Martínez-Caro et al., 2020; OECD, 2017). E-Government arises essentially from the 90's, simultaneously with the emergence of internet and, Digital Enterprise Transformation, including e-commerce practices (Diniz et al., 2009).

Recently, the concept of digital governance has emerged, as a continuity of e-Gov, with the exponential appearance of new ICTs. Interestingly, for some authors these two terms as synonyms (i.e., e-Gov vs. digital governance). Digital government is related to take full advantage from digital technologies, as well as, from the huge amount of data daily generated (big data). Among the aims of digital government are to restructure, simplify and enhance efficiently and sustainably services to citizens. Additionally, governments should ensure in public sector: open-source data compliant with the principles of transparency, integrity, accountability and participation and the management of this data to design and evaluate new services (OECD, 2018a; United Nations, 2020a).

Public Administrations will tend to be "open by default" and "digital by design", which allow the communication of needs by companies and citizens and the definition of public policies or public services with higher quality and spontaneity. In this context, it is expected the development of platforms to communicate not only between Public Administrations and citizens, companies or the civil society, but also between these stakeholders, in order to find innovative and creative solutions for countries' problems. Overall, these measures will contribute for a greater predictability of citizens' problems and for a proactive and rapid response to social problems by governments (OECD, 2018a). For instance, in European Union, Public Administrations (and public institutions) are intended to be "open, efficient and inclusive", aiming at providing boundless and intelligible services to all citizens and businesses. Therefore, Public Administrations must apply new digital opportunities to develop and deliver innovative, creative and useful services for companies and citizens (European Commission, 2016a).

Currently, diverse conceptual models of e-Gov are purposed. These models are applied to understand and optimize governance processes (Fath-Allah, Cheikhi, & Al-Qutaish, 2014; Morales & Bayona, 2020; Shahkooh, Saghafi, & Abdollahi, 2008; Supriyanto & Mustofa, 2016). Reference models are applied in business and within the scope of Public Administrations to optimize and/or create processes (Scholta et al., 2019). For instance:

1. United Nation model, which is defined in 5 steps: a) emergency (presentation of basic and static information on a limited number of official sites); b) addition (information is updated regularly); c) interaction (some services are available; users can download forms; contact services or make appointments); d) transactional (making financial transactions, which are available online) and e)

without limits (integration of all services, departments and administrative borders) (United Nations, 2002; Shahkooh et al., 2008);
2. Layne & Lee's model (2001): a) cataloging (presentation of information online, with download of forms); b) transactions (placing links to databases); c) vertical integration (integration between different levels of government) and d) horizontal integration (online integration between different levels and functions of government) or;
3. Practices for the automatic integration of reference models, for example through mathematical algorithms and / or artificial intelligence, in order to optimize or create new models that can be applied within the scope of Public Administrations (Plantera, 2017; Scholta et al., 2019).

Besides the implementation and dissemination of e-Gov in the last decades, digital enterprises have progressively emerged in markets. For instance, according United Nations Conference on Trade and development (2019), the predictable dimension of digital economy was 4.5-15.5% of world Gross Domestic Product, with United States and China representing almost 40% of world total ICT sector (United Nations Conference on Trade and development, 2019). Oppositely, in EU-28 less than 1/5 of companies were highly digitized (e.g. Business digitization and e-commerce), with the existence of significant variations between EU countries (e.g. from 50% of companies in Finland and Denmark to only 10% in Bulgaria, Greece and Latvia, regarding the predominance of digital enterprises) (2019 data) (European Commission, 2019a). In this scenario, e-Gov contributes to ensure interactions and communication between governments or Public Administrations and citizens, business or other private and public organizations (Diniz et al., 2009; Martínez-Caro et al., 2020; Martins & Veiga, 2020). Thus, study aims were defined, as follows:

1. To describe and analyze international recommendations on e-government, Digital Division and Management and Strategies for Digital Enterprise Transformation.
2. To present some practical cases of e-government, Digital Division and Management and Strategies for Digital Enterprise Transformation.

Moreover, diverse issues, controversies and problems emerging from study findings are discussed, as follows: future impacts of e-gov and digital divide on citizens lives, including on models of public administration, as well as, on digital divide and/or on management and strategies for digital enterprise transformation. Finally, solutions and recommendations and future research directions are presented at the end of Chapter.

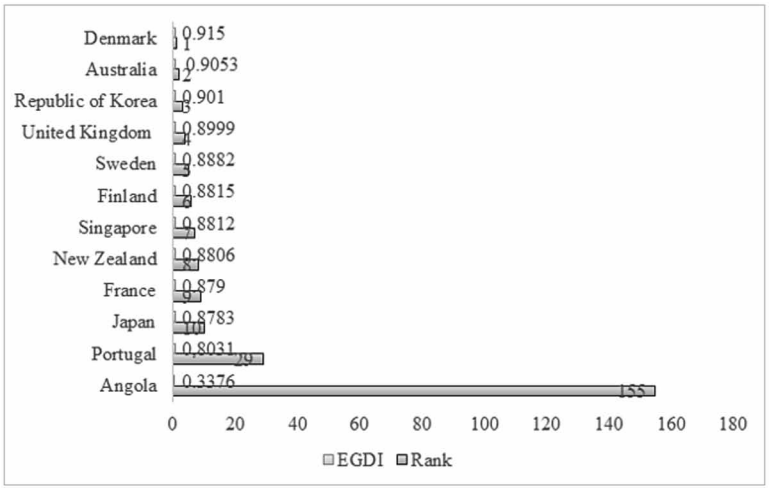
BACKGROUND

The level of e-Government may be quantified through the e-Gov development index (EGDI), which is provided by UN. This index covers 193 countries and is quantified based on the following indicators: Telecommunications Infrastructure; Human Capital Index; or Index of online services. In terms of EGDI ranking we have for example: Denmark (EGDI = 0.9150), Australia (EGDI = 0.9053) and Republic of Korea (EGDI = 0.9010) at top, Sweden in 5th position (EGDI = 0.882), USA in 11th position (EGDI = 0.879), Portugal in 29th position (EGDI = 0.8031) or Angola in 155th position (EGDI = 0.3376) (Figure 1) (United Nation, 2018a). Governments with lower EGDI provide a restricted number of e-Gov ser-

vices (e.g. electronic payments between public administrations and private sector), since they are less prepared/equipped (OECD, 2006).

Interestingly, digital divide (i.e. number of citizens, families, enterprises with a limited access to ICT and internet) and a restricted Digital Enterprise transformation (i.e. integration and optimization of ICT and internet in enterprises) seems to persist in some countries, despite a significant investment by many nations in e-government (OECD, 2006, 2017; Institute for Digital Transformation, 2017; United Nations, 2020a). In this sense, United Nations (2020), consider *as key pillars of a road map for digital governance transformation and digital capacity development* (among others): the access to high-speed broadband internet and access to new technologies for all, mobilization of resources, plans and budgeting, including through public-private partnerships and development of capacities at the societal level to bridge the digital divide and digital transformation (United Nations, 2020a).

Figure 1. EGDI and rank per country
(Data Source: United Nation, 2018a)



Concept of e-Gov

There are several definitions of e-Gov, including those of OECD, United Nations (UN) or European Union (EU), which are presented below:

- According to OECD, e-Gov is based on the use of ICT to adopt good governance principles and achieve political goals (OECD, 2019a).
- According to UN, e-Gov is based on the use of ICT to deliver government services more effectively and efficiently to citizens and businesses, i.e., applying ICT in government operations to achieve public ends by digital means. The principle underlying e-Gov is supported by an effective institutional structure of electronic governance to improve the internal functioning of the public sector, reducing financial costs and transaction times, in order to integrate and improve work flows and processes and to allow the effective use of resources in all countries (United Nations, 2019a). In addition, UN distinguishes between three types of e-government: (i) Government to

Government (G2G): related to data sharing and electronic exchanges between governments (e.g. international or national, provincial or local institutional services); (ii) Government for Business (G2B): related to business transactions (e.g. purchase / sale of goods and services) or online provision of services and (iii) Government for Consumer / Citizen (G2C): to facilitate interactions between individuals and governments, as consumers of public services or as citizens (e.g. provision or public decision-making) (United Nations, 2019a; Supriyant & Mustofa, 2016).

- According to EU, e-Gov refers to the use of ICT at various levels, namely in public administrations (e.g. intra and inter Public Administrations or between Public Administrations and citizens), in the digital single market (e.g. involving the participation of businesses and consumers), in terms of electronic payments (e.g. processing invoices / receipts), for replacing all paper-based procedures by electronic means and/or for developing innovative services (European Commission, 2019b).

Concept of Digital Divide

According to OECD's online glossary, the digital divide refers to the gap between individuals, families, businesses and geographic areas at different socio-economic levels, regarding opportunities for access to ICT and Internet use for a wide variety of activities, which reflects various discrepancies between and within countries (OECD, 2006).

Other Concepts: Digital Enterprise, Digital Enterprise Transformation and Management and Strategies for Digital Enterprise Transformation

Concept of Digital Enterprise

All enterprises that apply digital technology, including internet to operate. For instance, to produce products/services, to market those products/services, to acquire goods/services, to organize their structure, to select human resources, to communicate, to generate revenues or to innovate (Institute for Digital Transformation, 2017). In this setting, digital enterprise technology may be interpreted as a "theoretical framework for collaborative design and production development in the context of a product's lifecycle" (Maropoulos, Zhang, Chapman, et al., 2007).

Concept of Digital Enterprise Transformation

This concept is related to all enterprises that have faced (or are facing) a transition from the *Industrial Era* to the *Digital Era*, consequently integrating new technologies, including the use of internet in their structure. Besides structural and organizational changes, these transformations have led to a new culture and values in organizations (Institute for Digital Transformation, 2017).

Concept of Management and Strategies for Digital Enterprise Transformation

Nowadays, management and strategies for digital enterprise transformation is a tool to found new innovative and disruptive solutions, to enhance decision-making speed, to adjust process to clients' needs and characteristics or to reduce the number of required workers (Kateryna, Volodymyr, & Olena, et al, 2019).

MAIN FOCUS OF THE CHAPTER

In this section are presented study methods and recommendations about how to solve problems related to e-government, digital divide and Digital Enterprise Transformation (e.g. good international practices from EU, OECD and UN) and practical cases.

Research Methodology

The *database B-on* (Online Knowledge Library), which provides unlimited and payed access to research of higher education institutions and full texts of thousands of journals was consulted between November 2019 to May 2020 (B-on, 2020). The main keywords were, as follows: e-Gov; Digital divide; Good practices; Management; Strategies; Digital Enterprise and/or Digital transformation. Additionally, these keywords were browsed alone or in association with other keywords, such as Models, Definitions, Concepts, Artificial Intelligence, United Nations and/or OECD.

Good international practices/recommendations and practical cases about e-government, digital divide or digital enterprise transformation were browsed in the official websites of EU, OECD, UN, *B-on, Google Scholar and Research gate* (B-on, 2020). All papers, works/documents, reports or guidelines were conveniently selected. Recent, updated, credible and recognized papers/works of national/international merit were preferably selected.

Problems Related to e-Government and the Digital Divide: Good International Practices From EU

Given EU action plan for e-Gov (2016-2020), the main pillars to accelerate the digital transformation are: (i) modernization of Public Administrations, (ii) connectivity of public services across borders and (iii) involvement of citizens in the design and provision of new services (European Commission, 2019b).

In European Commission good practices is recommended to avoid digital divisions through combating social and economic gaps, increasing schooling and developing technological citizens' skills. For instance, implementation of a coherent technology/digital literacy program in order to avoid divisions, fragmentation and/or social isolation. Considering that social development is associated with a greater productivity, application of taxes and social contribution policies of companies to combat unemployment and retrain workers (e.g. EU's digital innovation centers) or development of local solutions may be supported by governments. Overall, social development must be based on ethical, socially acceptable and sustainable approaches to control the emergence of digital divisions in populations (European Commission, 2019c).

Problems Related to e-Government and the Digital Divide: Good International Practices From OECD

OECD recommendations to avoid digital barriers include: (i) promoting competition and removing barriers to investment in infrastructure (e.g. fiber), for instance each person is expected to be connected to at least three electronic devices until 2022; (ii) enhancing government incentives for ICT, regarding the incipient number of sophisticated users or the limited use of big data by small companies; (iii) increasing the governmental support for R&D and software patents (e.g. ICT patents: 33% of OECD countries vs.

60% Chinese in 2013-16); (iv) ensuring job stability despite digital social transformations, e.g. automation is expected to affect almost half of jobs; (v) fostering and supporting users' confidence, since around 1/3 of internet users have no confidence in social and professional networks (e.g. 15% of EU citizens refuse to shop online) and (vi) monitoring the dynamics of digital commerce markets (OECD, 2019b).

Problems Related to E-Government and the Digital Divide: Good International Practices From UN

Firstly, it is important to highlight that Millennium Development Goals (MDG) were established by United Nations in 2000. MDG aimed at eradicating extreme poverty and hunger; achieving universal primary education; promoting gender equality and empowering women; reducing child mortality; improving maternal health; combating HIV / AIDS, malaria and other diseases; ensuring environmental sustainability and developing a global partnership for development (United Nations, 2020b). MDGs were followed by the sustainable development goals (SDG) in 2017. There are 17 SDG, as follows:

1. No Poverty;
2. Zero Hunger;
3. Good Health and Well-being;
4. Quality Education;
5. Gender Equality;
6. Clean Water and Sanitation;
7. Affordable and Clean Energy;
8. Decent Work and Economic Growth;
9. Industry, Innovation, and Infrastructure;
10. Reducing Inequality;
11. Sustainable Cities and Communities;
12. Responsible Consumption and Production;
13. Climate Action;
14. Life Below Water;
15. Life on Land Peace;
16. Justice, and Strong Institutions and;
17. Partnerships for the Goals (United Nations, 2017).

In this sense, the seven main measures to overcome digital divisions purposed by UN are presented in Table 1 (United Nations, 2019b).

Table 1. UN main measures to overcome digital divisions

	Main Measures
1.	*Electronic strategies integrated in national development plans and priorities, which should be guided by MDGs.*
2.	*Implementation of political and legislative reforms with respect for the rights of the most disadvantaged.*
3.	*Use/articulation of official, private and / or non-profit resources to support ICT under MDG framework.*
4.	*Searching for multilateral solutions that encourage the transnational use of ICT.*
5.	*Defending the rights of the poorest countries through appropriate business models.*
6.	*Supporting and promoting ICT and connectivity, access, development and applications based on the pursuit of MDGs.*
7.	*Promoting a sustainable and innovative financing.*

Source: (United Nations, 2019b)

Problems Related to Digital Enterprise Transformation: Good International Practices From EU, OECD and UN

- UE: The political intervention and good practices of European Commission for Digital Enterprise Transformation are based on four pillars: (i) "Big data uptake" using security standards, 5G networks and construction of guidelines about data usage; (ii) "Reskilling the workforce: digital skills for industry" through implementation of financial schemes, creation of recommendations for industries and social partners, support academy digital initiatives from multi-stakeholder and entrepreneurship to acquire and develop digital skills, (iii) "Cities and regions as launch pads for digital transformation": smart governance on local digital ecosystem; support of digital talents and tech entrepreneurs; application of new solutions at a local and regional level or construction and manutention of key infrastructures and (iv) "Toolkit for decision makers to become ambassadors for digital transformation": digital training as part of continuous professional development and identification of disruptive technologies (e.g. social and regulatory impact) (European Commission, 2016b).
- OCED: Among other OCED focus: the future of jobs and skills in a digital world; the importance of digital transformation of firms and trade, as well as, the relevance of market openness in a digital economy. Future jobs will be straightly related to digital skills, due to the recent developments in artificial intelligence, appearance of new ICTs and the advancements of robotics. Importantly, digital transformation of firms is expected to improve productivity, enable innovation and reduce costs. For instance, market openness in a digital economy is likely to reduce costs and to spread ideas, innovations and technologies or to connect business and clients. Thus, workers' digital training, enterprise transformation and digital economy should be equitably supported by governments, while the gaps between developed and developing countries should be fought through the implementation of national strategies, improvement of internet access, increasing competition in telecommunications, ensuring digital security, controlling privacy risks, reducing firms barriers, supporting investments, improving workers' skills, promoting internet openness or ensuring cross-border data flows (OCED, 2017; 2018b).
- UN: United Nations supports the creation of an inclusive digital economy, with the safeguard of human rights, trust and social inclusion. According to UN, digital technologies may contribute to disseminate information and for an inclusive global economy: "Developing an inclusive digital

economy will require sustained and coherent effort from many stakeholders across all walks of life. National policy frameworks and international agreements need to find ways to promote financial inclusion, innovation, investment and growth while protecting people and the environment, keeping competition fair and the tax base sustainable" (United Nations, 2018b).

Additional Studies About E-Government, Digital Divide and Digital Enterprise Transformation: Best Practices and Other Variables

The capacity of a nation adopt e-Government is related to their financial position, infrastructure facilities and technological innovations, political and legal frameworks, organizational, institutional and socio-cultural aspects. These variables may explain e-Government implementation challenges, for instance in small countries, such as Cyprus (Glyptis et al., 2020). Alhomod et al. (2012), discussed the urgent need of implementing e-Gov for increasing efficiency and quality and reducing costs of governance (e.g. better citizens' services). These authors have identified 3 models for international best practices in e-government: model 1 ("Variety and best practice (VBP) model"), which is based on software engineering; all operations provide an output (e.g. United Kingdom); model 2 ("CIVIC IDEA"): hierarchal model that applies effective tools for executing strategies of e-government (e.g. United Arab Emirates) and model 3("Strategic framework of e-government"), which is based on the existence of a front office and back office; each subpart contain framework modules (e.g. European Union) (Alhomod et al., 2012).

Regarding the reduction of digital divide, the recommend measures are described, as follows: to promote education and literacy of populations, to provide incentives for the involvement of impaired people in the development/design of new technologies, to offer technical assistance in using new technologies, to develop and optimize legislation and policies, especially in view of supporting the more disabled citizens, such as provision of employment or income support (Tomczyk et al., 2019). The mitigation of digital divide is especially relevant, since information and communication technologies can substantially improve people's lives, and reduce social inequalities (Sargent & Ahmed, 2017). Digital gaps must be eliminated during COVID-2019 pandemic, for instance to reduce inequalities in health care provision (e.g. telehealth, and telemonitoring) or education (e.g. e-learning) (Ramsetty & Adams, 2020).

Significant competitive advantages may be attained in business, through digital enterprise transformations, such as adoption of In-Memory Analytics, Cloud Computing, Mobile Connectivity, and Social Media (Uhl & Gollenia, 2014). Interestingly, COVID-2019 pandemic has contributed to accelerate the digital transformations of companies, because of the need of ensuring social distancing. For instance, training, upskilling, and reskilling on digital technologies of employers have increased (Callahan, 2020). Similarly, e-commerce has clearly improved during COVID-2019 crisis, since consumers were required to adapt to lockdowns. In this sense, digital divide within and across countries should become a world priority, while Digital Enterprise Transformation should be supported and stimulated (WTO, 2020).

Practical Cases about e-Gov, Digital Divide and Digital Enterprises, Including Comparative Studies Between E-Governance and Digital Enterprise Transformation

European Union

In EU, the % of households with internet access was 87% in 2018, although only 57% of individuals (16-74 years) have purchased goods or services in internet (Eurostat, 2018). Regarding EU enterprises, 92% used broadband internet, but only 45% used social networks and 77% had a website in 2018 (Zecevic, Stojanovic, & Cudan, 2019). Among the motives for a limited number of online purchases are citizens' mistrust, insecurity and lack of privacy by internet users (OECD, 2019b). Thus, EU has been pursuing efforts to safeguard citizens' security and privacy. This situation was substantiated by recent legislative changes, namely in October 2015 the "Safe Harbor Agreement" was invalidated by the Court of Justice of the European Union (CJEU), since many US companies (about 4500 US companies) were making transfers of data based on this agreement. After that, a new "Privacy Shield" agreement was launched in February 29, 2016, providing greater privacy for users /EU citizens. This new agreement aimed to ensure the privacy and security of citizens based on the decisions of CJEU (Bhasin, 2016).

United States

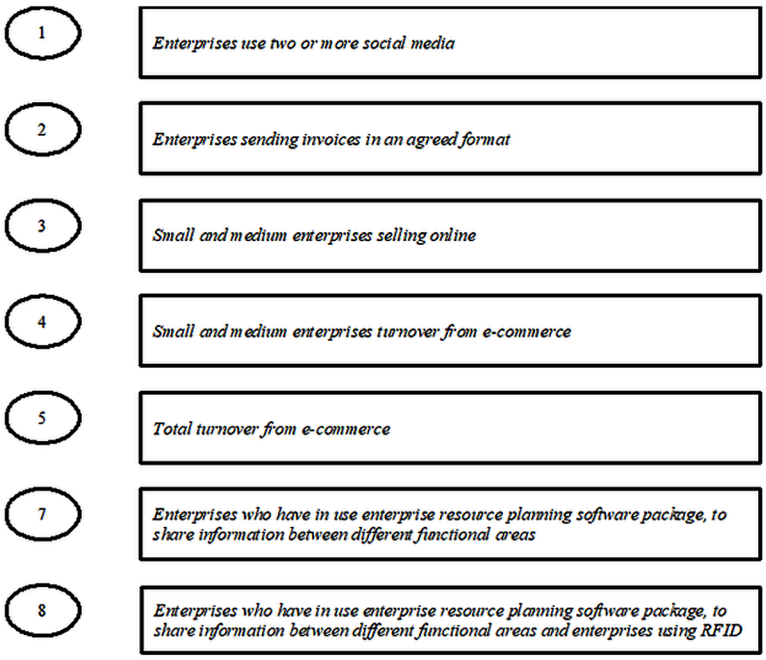
The rapid development of ICTs has enabled innovative and global collaborative process, with increases in marginal productivity (late 1980s to 2000) (Fukuda, 2020). However, around 30 million citizens do not have access to internet in US, high-speed internet present 97% coverage in urban areas vs. only 65% coverage in urban areas. For solving this problem, the Federal Communications Commission (FCC), which is the American federal agency that regulates communications between states and implements and enforces communications legislation in the USA supported the creation of several funds, namely the "Rural Digital Opportunity Fund" (up to 20.4 billion) or the "Connect America Fund Phase II" (1488 billion) to expand broadband in rural areas, including 700,000 rural locations in 45 states (FCC, 2019).

Estonia

Estonia is one of the most digitized societies in the world, while comprising a population of just 1.3 million. After their independence from the Soviet Union in 1991, the essential pillars of e-revolution were supported by the digital programs of successive governments. A strong investment in an online economy and in massive innovation in the technological area was initially implemented (e.g., e-Estonia initiative). Subsequently, a widespread use of internet and ICT for education, science and culture was established in Estonia, with the involvement of public-private partnerships (e.g. up to 91.4% of citizens use internet in 2016). The first project to overcome digital divide was the provision of free training about the use of computers, which covered 10% of Estonian adult population. Recently, other projects have been implemented, such as a programming training for children from the age of 7 or 400 startups were installed to attract new talents (2016). A curious fact is that Estonian citizens can monitor their own privacy, as they have the possibility of consulting a state portal (eesti.ee) to verify who tried to access their data, which ensures high levels of transparency in relation to internet. Another disruptive example of citizen participation is based on using Rahvaalgatus.ee portal to send collective initiatives to the

Estonian Parliament. This initiative support policies of open governance and e-democracy (Eisermann, 2014; UNESCO, 2019).

Figure 2. Eight indicators for the calculation of Digital Technology Integration Index (DTII)
(Data Source: European Commission, 2018)



Angola

e-Gov appears in Angola essentially from the end of the 90s. Their appearance was marked by several events, such as ITU Plenipotentiary conference in Minneapolis (1998), creation of the Y2K commission (2000) or 1st World Information Society Conference held in Geneva (2003). These events supported the development of the Information Society Development Strategy (2000-2010) and the White Telecommunications Book in Angola (Alfredo, 2015; MTTI, 2017; Costa, 2016; Government of Angola, 2011). Digital divide persist in Angola, which may be justified by a high illiteracy rate, a low digital literacy, limitations on internet access ("the number of mobile broadband subscribers rose from 2.7 per 100 people in 2010 to 22.3 per 100 people in 2016"), the high costs of ICT or a limited access to electricity from the public grid (Das & Drine, 2000; World Bank, 2018).

Comparative Studies Between E-Governance and Digital Enterprise Transformation, Including the Use of ICT's

The Digital Transformation Enablers' Index (DTEI) provides a ranking *based on the assumption that infrastructure, access to finance, and the demand and supply of skills are the most important factors driving digital transformation.* The comparison between DTEI scores across the member states of Eu-

ropean Union showed that the three highest-scoring economies were Netherlands (81.6), Finland (79), and Sweden (77.7) (2018 survey). Contrary, the tree lowest-scoring economies for DTEO were Romania (22.2), Latvia (25.2) and Poland (32) (2018 survey). The Digital Technology Integration Index (DTII) was also considered in this comparison. DTII is based on eight indicators, which reflect modifications in the digital transformation of European businesses (Figure 2).

The comparison between DTII scores across Member States shows that the three highest-scoring economies are Denmark (62.4), Ireland (55.7), and Finland (55.7). In opposition, the three lowest-scoring economies for DTII were Romania (18.6), Poland (21.6) and Latvia (22.7). These findings show clear variations in terms of digital transformation across the member states of European Union (European Commission, 2018).

As expected, countries with enterprises using more developed ICTs present a higher level of e-commerce practices (e.g. Ireland – 35% and Belgium – 32%; the only two countries in European Union with more than 30% of total turnover from e-Commerce for enterprises employing 10 or more workers). The use of ICTs contributes for better services and profits, with a positive impact in economy and society. The lowest turnover from e-commerce was achieved for Bulgaria, Greece, Cyprus, Latvia, Romania, and Montenegro, countries with a lower use of ICTs in business (Zoroja et al., 2020). Digital divide of business, namely in small and medium-sized enterprises may be explained by their low productivity and/or bankruptcy. ICTs use by enterprises is positively related to better access to technology, internet and human resources' skills and attitudes on ICTs (De Souza, et al., 2017).

Importantly, e-Gov may positively influence the development of digital economy, with the progressive implementation of public services dedicated to e-Business (Martins & Veiga, 2018). European citizens buying goods through internet report to use e-Government tools (e.g. Ireland and Estonia) (Year et al., 2020). A study covering 174 countries (2004 to 2016), confirmed that innovations in e-government may create a more supportive environment for business and a more competitive/dynamic economy. Diverse indicators have been considered in this study, such as facility for starting a business, registering property, getting credit, protecting minority investors, getting electricity, paying taxes, trading across borders or enforcement of contracts (e.g. through the existence of e-Gov tools to carry out these tasks). The best scores on "Ease of Doing Business indicators" were found for Denmark (84.9), followed by United Kingdom (82.7) and Sweden (82.1) (EU-28 average 76.3) (Martins & Veiga, 2018). For instance, diverse e-Business applications were developed through e-Gov services in Croatia, namely E-REGOS (The Central Registry of Insured Persons: related to the obligatory contributions for the pension fund), E-VAT (for payment of taxes), E-Custom declaration (for submitting annual custom application), Financial Reports (statistical reports of entrepreneurs), WEB-BON (information about solvency) or e-CREW (for registering crew and passengers through Internet) (Spremić & Brzica, 2008).

ISSUES, CONTROVERSIES, PROBLEMS

E-gov and Digital Divide: Citizens Impact

It is likely that digital gaps will decrease in future, between developed and developing countries or between urban and rural areas due to a growing globalized access to the internet and ICTs, as well as, the tendential dissemination of broadband internet to all regions of planet, consequently contributing to e-Gov spread (Hawash & Lang, 2020; United Nations, 2020a). It is also expectable that users/citizens

will be more educated, literate and consequently more likely to use/master emerging and innovative ICTs. For instance, so-called "Nerds" of information technology may grow due to a higher literacy/education and access to new ICTs. In contrast, excluded niches of society may simultaneously coexist, as well as, some limitations on education access may persist, especially in developing countries. These niches possibly will tend to remain isolated, regarding the use of internet and ICT, whether due to economic restrictions or personal and/or cultural limitations. Importantly, highly educated people may purposively choose to make a more selective use of ICTs and internet (Scheerder et al., 2020; United Nations, 2015).

E-gov and Digital Divide: Possible Impacts on the Traditional (Bureaucratic) Model / and Other Current Models of Public Administration

In public governance, it is possible to identify three main types of structures: governments, markets and cooperation entities (e.g. society and networks). Historically, Public Administrations experienced profound policy and organizational changes, since 1980s (e.g. concepts from the private sector were incorporated into the public sector in the last decades e.g. benchmarking). Three major public management models are classically proposed: (i) bureaucratic model; (ii) new public management and (iii) new public governance (governance). Max Weber's bureaucratic model was predominant during the 19th and 20th century. This model was characterized by the existence of an authoritarian administrative hierarchy (formality/impersonality) simultaneously with delineation of duties and responsibility, and subsequent award of merit (in opposition to the nepotist and patrimonialism of pre-bureaucratic model). New public management was based on efficiency, effectiveness and competitiveness (e.g. rational use of resources, accountability, evaluation focused on results/outputs and/or capacity to answer a certain problem or achieve a certain objective). New public management was predominant in 80s and 90s and was followed by new public governance. New public governance involves several players in the construction of public policies such as, more participatory or neoliberal mechanisms, with a decrease in the monopolistic role of the state. For instance, an increase in the number of interactions between state and non-state actors (e.g. public-private partnerships) (Filho et al., 2016; Secchi, 2009).

Nowadays, different models of public management tend to coexist (e.g. new public management or new public governance), which is accompanied by a decline of the bureaucratic model (Filho et al., 2016; Secchi, 2009). Simultaneously, e-Gov emerged in Public Administrations, which are "open by default" and "digital by design" (OCDE, 2018a). In this scenario, diverse measures were implemented by governments, such as increase of digitalization practices, fight of digital gaps, search for more efficient, effective governments and potentiation of interactions between state/non-state stakeholders (Asgarkhani, 2005; OECD, 2018a, 2019abc). Digital divide between different countries/regions or restrictions in the access to ICTs should be avoided, for instance through control and monitorization of levels of citizens' income, education, socioeconomic status, commercial activity or dimensions of companies/business (Asgarkhani, 2005).

E-Gov: Digital Divide and Digital Enterprise Transformation

It seems that advancements in e-gov (e.g. internet access for all, promotion of citizens' digital capacities or mobilization of resources through public-private partnerships) are likely to contribute for the mitigation of digital divide, but progresses in e-gov may not be necessarily related to reduction of digital divide or promotion of digital transformation. For instance, Africa has made significant progress in the

development of e-government in the last decades, although 54 African countries remain in the low EGDI group, with a significant level of digital divide and/or limited digital transformation. African countries need to adopt political measures to successful improve citizens' digital capacities and access to internet and improve digital transformations of society (United Nations, 2020a). Moreover, studies based on data from developed countries (e.g. European Union) support the existence of a relationship between the digital divide and citizens' use of e-government, namely the existence of a positive relationship between income and citizens' use of e-government, as well, as the existence of a positive relationship between education and citizens' use of e-government. It was found that new technological tools of e-government may be especially beneficial for some segments of population (e.g. more educated/literate individuals) (Pérez-Morote et al., 2020; Rogers, 2003).

Management and Strategies for Digital Enterprise Transformation

According OCDE data, the level of digital transformation varies between regions, countries, sectors, organizations, etc. Today most of the business apply digital technologies, but their full potential is clearly unexplored. For instance, only 20% of enterprises have benefited from high-speed broadband in OECD countries during 2018. Interestingly, highly digital-intensive sectors quickly evolve, with these sectors presenting a fast scale-up, with 55% higher mark-ups ("the wedge between the price a firm charge for its output and the cost the firm incurs to produce one extra unit of output"). These highly digital-intensive sectors are likely to ensure more jobs (e.g. around 40% of the 38 million jobs added in OECD area IN 2006-2016). For instance, 25% to 50% of worker as ICT specialists in information industries. In opposition, highly digital-intensive sectors may present more expressive business declines in some situations (OECD, 2019c).

SOLUTIONS AND RECOMMENDATIONS

The suceffuly implementation of e-Gov, mitigation of digital divide and/or potentiation of digital transformation (e.g. digital enterprise transformations) should be strictly and independently monitored, since they are not necessarily interrelated (e.g. the advancements of e-Gov in African countries have not mitigated the constrains of digital divide and/or transformation). All digital activities should be monitored by governments, international authorities or independent institutions (public or private). These organizations can implement corrective measures (when applicable) (United Nations, 2020a). This supervision seems to be especially relevant during COVID-2019 pandemic to eliminate inequalities between countries, for an equitable access to education, and health services or the supply of first necessity goods (Lashitew, 2020).

Stimulating regional economic growth, fostering higher education or increasing Research & Development (R&D) were among the potential political measures to effectively reduce the digital divide at national or regional level (Szeles, 2018). Besides digital infrastructures (e.g. business/enterprises applying digital tools and ICTs) and investments (e.g. digital technologies), workers´ digital skills, e-leadership (e.g. training of leaders), entrepreneurial culture and changes in ICT (e.g. entrepreneurial behavior) and start-ups environment (e.g. number and type of start-ups) are some of the leading the framework conditions for digital transformation (e.g. Estonia) (Interreg Europe, 2018). In another study from USA, the identified variables for the formulation of federal policies, with a significant positive impact on the use of

ICT and, consequently, on the control of the digital divide were as follows: social capital (e.g. immigrant population), education, social openness (e.g. democratic values and regulatory quality) or urbanization and ethnicity (Pick et al., 2015). Digital solutions, citizens' and workers' continuous training on digital skills and big data management may contribute to achieve specific economic and social solutions in a certain geographic area, namely contributing for the development of digital enterprise transformation (European Commission, 2016b).

Currently, digital divide is also being debated in OECD forums, namely: the potential of public-private partnerships to promote internet access in developing countries and rural areas; the relevance of socioeconomic limitations on internet use or digital capacity applied to work automation; the digitization as a useful tool to regulate gender division or digital innovation to ensure the rights of disabled people compared to other citizens (OECD, 2019d). Importantly, human rights, citizens' trust and social inclusion should be watched and protected (United Nations, 2018b).

United Nations, World Trade Organization, research centers, academies, governments and other international instituions should address the problems of the "Managment and Strategies for Digital Enterprise Transformation" to achieve a tailored global solution. Nine identified pillars on capacities for digital transformation were already purposed by United Nations (2020) (Table 2).

Table 2. Pillars on capacities for digital transformation purposed by UN

	Purposed Pillars by United Nations
1.	*Vision, leadership, mindsets: Strengthen transformational leadership, changing mindsets and digital capacities at the individual level.*
2.	*Institutional and regulatory framework: Develop an integrated institutional ecosystem through a comprehensive legal and regulatory framework.*
3.	*Organizational setup and culture: Transform the organizational setup and culture.*
4.	*System thinking and integration: Promote systems thinking and development of integrated approaches to policymaking and service delivery.*
5.	*Data governance: Ensure strategic and professional management of data to enable data-driven policymaking and access to information through open government data, among other data access and use priorities.*
6.	*ICT Infrastructure, affordability and accessibility to technology.*
7.	*Resources: Mobilize resources and align priorities, plans, and budgeting, including through public-private partnerships.*
8.	*Capacity of capacity developers: Enhance the capacity of schools of public administration and other institutions.*
9.	*Societal capacities: Develop capacities at the societal level to leave no one behind and bridge the digital divide.*

Source: (United Nations, 2020a)

Thus, the development of international guidelines on Management and Strategies for Digital Enterprise Transformation by the national and international fora, as well as, their transposition to national polices and regulations is highly recommended. Besides, the contribution of Digital Enterprise Transformation may be especially relevant to enterprises during COVID-2019 pandemic (e.g. development of guided digital business and manutention of competitivity of business), since social distancing is recommended to avoid the propagation of the virus SARS-CoV-2. Importantly, some initiatives are already been taken, such as Global Declaration on the Digital Response to COVID-19 (60 countries), co-sponsored

by Estonia and Singapore, to support the empowerment of societies through digitalization for a better future (e-Estonia, 2020).

Finally, e-Gov may be developed/optimized as a tool to achieve digital enterprise transformation, since more digitalized public services are more likely to be related to better digital infrastructures (e.g. dissemination of high-speed broadband internet in rural areas), which also facilitate digitalization of companies (United Nations, 2020a). Digital enterprise transformation and/or interactions between e-Gov and private bussiness may be supported through:

1. Provision of financial incentives or technical support to business that apply digital transformation;
2. Supervision of e-commerce by e-Gov to avoid smuggling and counterfeiting of goods or evasion of taxes payments;
3. Development of new regulations and;
4. Adoption of political measures that support the interaction between e-Gov and digital enterprises, such as creation of specific digital channels between enterprises and public administrations through e-Gov as a way of promoting digital transformations of companies and increasing the efficiency of public services (e.g. payment of taxes, communication of alerts about the safety and quality of products, such as medicines, or the transmission of legal notices or information about alterations in regulations) (United Nations, 2020a).

FUTURE RESEARCH DIRECTIONS

It is expected a likely increase in the use of ICT, with profound social changes and direct impact on the daily lives of citizens (e.g. internet of things or artificial intelligence); an increase in internet access and a decrease in digital gaps, as a result of the application of political measures by governments; the integration of ICT in education; an enhancement of intelligible, sustainable and focused R&D; the development of innovative ICT; the management of big data or the emergence of new social realities (Hawash & Lang, 2020; Scheerder et al., 2020; United Nations, 2020a). Besides the existence of more proficient users of ICT (e.g. computer nerds and citizens of high digital literacy), certain social groups may maintain a restricted access to ICT due to social, cultural or economic motives. Similarly, it is expected digital enterprise transformation growth, especially in developing countries where the access to internet is still limited in some regions (European Parliament, 2020; Hawash, 2020; Ilavarasan, 2020). Cybersecurity is of great importance, since citizens/clients are suspicious about the security of e-commerce and the number of cyber attacks is constantly growing (European Parliament, 2020; Robinson & Surya, 2019; Statista, 2017).

The development of political strategies and the optimization of national and international regulations are recommended to support Digital Enterprise Transformation (OCDE, 2019b; WTO, 2020). Additionally, it is suggested more studies about the impact of e-Gov improvements on digital divide and/or digital enterprise transformations (e.g. relevance of Digital Enterprise Transformation during COVID-2019 crisis) in developed and developing countries (Lashitew, 2020; Ramsetty & Adams, 2020).

Thus, governments, regulators, citizens, media, public or private associations, academies and R&D centers are required to manage, monitor, develop and investigate the access to innovative ICT, digital divide, digital enterprise transformation (e.g. how e-Gov can be used for the digital enterprise transformation), to monitor the possible emergence of new social problems or constraints and the maintenance

of democratic rights of all citizens, especially for the poorest and most disadvantaged one (European Parliament, 2020; WTO, 2020; Yera, 2020).

CONCLUSION

In comparison to other recent studies, this review provides highly up-to-date figures on the status quo and the development of e-Gov, digital divide and digital enterprise transformation in international comparison (e.g. good practices, recommendations/guidelines, reports and/or practical cases). Globally, it was considered that international recommendations on e-government, Digital Division and Management and Strategies for Digital Enterprise Transformation are already producing successful outputs (e.g. e-Estonia initiative), but more actions are required to overlap digital gaps between developed and developing countries, as well as, to face the new societal challenges, such as those emerging from COVID-2019 crisis (reply to research question) (e-Estonia, 2020; Ramsetty & Adams, 2020).

e-Gov or digital Gov has undergone a significant evolution in the last decades, with the exponential increase and innovation of ICT. New theoretical models are appearing to explain these transformations, including digital divisions and digital enterprise transformation. Practical cases illustrated different levels of e-Gov and digital divide between countries. For instance, political approaches and measures of different governments and international institutions seems to be heterogeneous according to the concrete needs of each country or region. Despite the model(s) of Public Administration in force in a certain country (e.g. new public management or governance or a mixture of both), Public Administrations tend to be "open by default" and "digital by design" (OCDE, 2018a). This favor real-time interaction intra-APs from different countries, real-time communication with citizens and enterprises or citizens' civic participation, namely in the process of making or proposing new political decisions. Thus, ensuring literacy and digital proficiency of all citizens is essential for guaranteeing quality of life, employment, rights and civic participation within society. It seems that there is a positive relation between advancements in e-Gov and the reduction of digital divide and/or a better digital transformation, including of enterprises, but there are exceptions. For instance, some countries (e.g. African countries) present a significant progress in e-Gov, but not in the elimination of digital divide or promotion of digital transformation (e.g. e-business practices). Thus, governments should monitor the level and efficiency of e-Gov, digital divide and digital transformation as independent variables for taking appropriate political and administrative measures (OECD, 2018b).

Several national and international entities are determined in promoting e-Gov and digital enterprise transformation to bridge digital, social and economic divisions between developed and developing countries, while safeguarding the interests of the poorest and most disadvantaged nations. For instance, EU, OECD and the United Nations have indorsed debates and developed international orientations about e-Gov and e-commerce. These orientations may be applied to combat digital divisions at local, regional, national, international and global levels, such as through funds to ensure the internet access in rural areas, delivery of digital assistance, provision of incentives or technical resources for digital enterprise transformation or the implementation of measures to increase citizens' and enterprises/firms digital literacy and skills (European Parliament, 2020; OECD, 2019b; United Nations, 2019b; WTO, 2020).

Empowerment of e-Government, including e-Business tools to support companies, mitigation of digital divide and promotion of digital enterprise transformation (e.g. e-commerce) seems to be especially relevant during COVID-2019 pandemic to safeguard social distancing, to enhance economy and/

or to provide social support, education or health care services (e-Estonia, 2020; Ramsetty & Adams, 2020; United Nations, 2020a).

DISCLOSURE

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KEY TERMS AND DEFINITIONS

Digital: Application of digital signs (e.g. series of numbers) in ICTs, such as computer technology.

Digital Divide: Gap between individuals, families, businesses and geographic areas at different socio-economic levels, regarding opportunities for access to information and communication technologies and internet use.

Digital Enterprise: All enterprises that apply digital technology, including internet to operate.

Digital Enterprise Transformation: All process related to the integration of digital technologies and resources in an enterprise.

E-Government: e-Gov is related to use of information and communication technologies (ICTs) to achieve political goals and to ensure an efficient functioning of public administrations.

E-Government Strategies for Digital Enterprise Transformation: Application of ICTs by governments to support digital interactions with companies, as well as, to improve e-business implementation and outcomes, resulting in a better economy.

Information and Communication Technologies: ICTs integrate diverse types of technologies, such as telecommunications, audiovisual, software, laptops or other electronic devices to access, store/stock, diffuse, process or manage information.

Management: The supervision: control, and organization of a certain activity.

Management of Digital Enterprise Transformation: All process related to the management of digital technologies and resources in an enterprise.

Strategies for Digital Enterprise Transformation: All plans and policies that may be applied to achieve digital enterprise transformation.

Strategy(ies): A a plan to attain a certain purpose/goal.

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