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Business Management and Communication Perspectives in Industry 4.0

Aysegül Özbebek Tunç and Pınar Aslan

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Business Management and Communication Perspectives in Industry 4.0

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and tremendous progress to organizations of all shapes and sizes, on a magnitude beyond the current imagination. The disruptive technologies introduced by I4.0 represent a leap forward from more traditional automation to next generation industrial production based on fully web-based cyber-physical systems (CPS)s. To full understand the I4.0 concept and implementation, this chapter makes an in-depth analysis on the issues and controversies of I4.0, recent technological advancement, management and organizational concerns in terms of opportunities and threats, capital investment and skillsets, cybersecurity threat, ethics consideration, current challenges facing organizations and industry in terms of geopolitical domination, economic and social disenfranchisement, job destruction and job creation, the roles of multinational corporations, lack of technologies capabilities, lack of skillset, and skill mismatches. This chapter also makes suggestions for solutions and recommendations in terms of the role of government and incentives and grants; assessment tools; collaboration; the development of local companies and small and medium-sized enterprises (SMEs); upskilling, reskilling, and lifelong learning; education; universities and students; skilled graduates; and future research and directions.

This chapter brings online communities, open innovation, and Industry 4.0 concepts together to build a framework for using online communities in an open innovation understanding in Industry 4.0 context. While online community and open innovation field of studies are being studied for a period of time, Industry 4.0 is rather a new topic which needs further understanding. Literature lacks studies that suggest a framework, especially integrating cloud-based design manufacturing and social product development concepts which are related to Industry 4.0. This study tries to fill in this gap by explaining how online open innovation communities can be created in Industry 4.0 context, what is needed for user participation, motivation, interaction, and what concepts that a company can use to build a collaborative culture and innovative outcomes.

The digital industrial revolution, also called Industry 4.0, is substantially changing all areas of business. The application of modern technologies is transforming not only products and processes in the industry, but also business models in all sectors, which further implies required adaptations of all business functions. This chapter addresses the new dynamics and implications for strategic communication brought on by digitalization. A planning process of strategic communication will be elaborated within a digital context, together with the specifics of communicating with younger generations. Communication activities mostly relevant for companies in the new industry will also be presented. The issue of ethics in strategic communication will be also addressed, together with major initiatives in regulating the standards of the profession. The purpose of this chapter is to describe the changes that new technologies have brought to the discipline.

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With the developments in technology and innovation, the manufacturing, workforce, training, and educational systems were affected. Facing the fourth industrial revolution, academics are researching the possible changes that might arise in education and skills of the future workforce. As the workplace develops, new competencies will surface. With this context in mind, the authors initiated this research. A detailed questionnaire was prepared as a pilot study to comprehend students' views on the use of technology in classrooms and its impact on their learning experience and engagement. Knowledge of their views allowed the authors to draw inferences as to the skills and competencies of future students and whether they would match Industry 4.0. Furthermore, a gap analysis was conducted, whereby the existing situation at a Canadian higher educational institution was compared to the desired situation, and recommendations were put forward.

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Preface

Changes in the global economy bring new dynamics, concepts and implications that require digitalization and adaptation. Companies have to comprehend the current economy which was called 'new normal' first and turned out to be referred as the 'Industry 4.0' or 'The Fourth Industrial Revolution'. Today it is important for companies to gain an overall and multifaceted understanding about the digital world and rising technologies, and to cope with this world through their leaders. They should follow breakthroughs to adapt and even co-change the fast-changing environment. For this necessity, companies should get the picture of digitalization with its mindset and its dynamics. It is essential not only to manage marketing or financing activities but also communication issues in terms of digitalization in a company. Adopting such a strategy is a must for today's companies if they want to survive in the ever-changing business environments. As today's industry is quite complex with its changing rules, this brings a certain need to understand the nature of the new business platforms and then act accordingly. This study intends to come up with the chapters that will serve as the guidelines of the changing business world in terms of management, communication, and leadership.

This book is organized as a manual of the Industry 4.0 in terms of management and communication. Although both scholars and practitioners are quite aware of the fact that times are changing and businesses need to adapt to this change, there is a certain sense of obscurity when it comes to decide what to do. This book could be considered as a roadmap to follow when it comes to follow, plan, implement, and evaluate strategies for Industry 4.0. Focusing on management and communication, the main aim is to explain and suggest solutions on many issues such as business management, leadership, strategic communication, social media, crisis management, organizational structure, business models, digital marketing, digitalization strategies. Main objectives of the book can be summarized as follows: theorizing about tomorrow's business and communication environments based on the past and present of the concepts, blending managerial and communicational concepts with a multidisciplinary approach and discussing concepts of Industry 4.0 by integrating knowledge from business and communication fields. The target audience of our book are managers, communication specialists, strategists, researchers, students, investors, academicians, policy makers, future analysts.

In Chapter 1, titled as "Digitalization Strategies in the New World Order: A Conceptual Study to Understand Digitalization Strategies", the author aims to explain how to make the right choice from a variety of digitalization strategies from IT strategy to digital orchestration strategy depending on organizations' need to digitalize, their digitalization capabilities and transformations that they have experienced define their routes in the digitalization process.

Chapter 2 is titled as "Understanding Digital Congruence in Industry 4.0" and the main focus on the text is the fact that digital transformation has become a major driving force of Industry 4.0 for organi-

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zations. While Industry 4.0 presents key opportunities to boost competitiveness and promotes digital change, development of digital capabilities is significant for organizations to be better prepared to implement these advances. In this respect, the chapter focuses on the term "digital congruence" that relates to culture, people, structure and tasks in organizations and explains the link between digital congruence and Industry 4.0

Chapter 3, titled as "Opportunities, Challenges, and Solutions for Industry 4.0", aims to make an in-depth analysis on the issues and controversies of I4.0, recent technological advancement, management and organizational concerns in terms of opportunities and threats, capital investment and skillsets, cybersecurity threat, ethics consideration, current challenges facing organisational and industry in terms of geopolitical domination, economic and social disenfranchisement, job destruction and job creation, the roles of multinational corporations, lack of technologies capabilities, lack of skillset and skill mismatches to fully understand the I4.0 concept and implementation. It also make suggestions for solution and recommendations in terms of the role of government and incentives and grants, assessment tools, collaboration, the development of local companies and Small and Medium-sized Enterprises (SMEs), upskilling, reskilling and lifelong learning, education, universities and students, skilled graduates, and future research and direction.

The chapter regarding "A Framework Development Effort for Using Online Communities in an Open Innovation Understanding" brings online communities, open innovation and Industry 4.0 concepts together to build a framework for using online communities in an open innovation understanding in Industry 4.0 context. While online community and open innovation field of studies are being studied for a period of time, Industry 4.0 is rather a new topic which needs further understanding. Literature lacks of studies that suggest a framework, especially integrating cloud based design manufacturing and social product development concepts which are related to Industry 4.0. This study tries to fill in this gap by explaining how online open innovation communities can be created in Industry 4.0 context, what is needed for user participation, motivation, interaction and what concepts that a company can use to build a collaborative culture and innovative outcomes.

The next chapter is titled as "'New Normal' Strategic Communication" and it addresses the new dynamics and implications for strategic communication brought on by digitalization. A planning process of strategic communication is explained within a digital context, together with the specifics of communicating with younger generations. Throughout the chapter many topics that are related to strategic communication are discussed with the possible changes that come along with digitalization.

Chapter 6, "Digital Marketing Suggestions for Companies", aims to focus on digital marketing strategies for businesses that need to step into the digital world in industry 4.0 and make many decisions such as price and promotional activities in manufacturing processes, supply chain and distribution systems. The chapter aims to provide some valuable insight into today's and tomorrow's marketing strategies.

Next chapter is on "Social Media as a Communication Channel" since in today's and tomorrow's world people spend most of their time on social media. The authors focus on the fact that with Industry 4.0, all devices are connected to online platform, smart devices get more place in daily life. Instead of accessing information through individual applications, consumers prefer to obtain information from the company's social media pages and / or the company's internal and external customers' shared content. The purpose of the chapter is to indicate the importance of social media use, for organizations to interact effectively with all stakeholders and, to explain the benefits of social media usage of organizations in terms of different functions with examples from best cases and results of empirical researches.

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Chapter 8 is titled as "Can Internal Social Media and Data Mining Be a Powerful Communication Vehicle in Reaching Employees in Change Management in Industry 4.0?" and the main aim of the chapter is to capture the readers' attention towards the relationship between change management and Industry 4.0 tools specifically- Social media and data mining. The author addresses social media platforms as possible internal communication tools and aims to find out whether it is possible to use social media in such a way.

Chapter 9, "The Nature of Digital Leadership in Managing Employees Through Organizational Culture", questions whether leaders and public relations professionals change their current strategies to adapt themselves to the new digital environments. Based on the premise that the managers of the future will probably need all the flexibility, emotional intelligence and creative thinking, the purpose of the study is to determine the influence of digital leadership on start-up companies regarding technological and social influences of Digital Age across different demographics.

Chapter 10 is "Artificial Intelligence Leadership: Imitating Mintzberg's Managerial Roles" and aims to discuss how artificial intelligence may affect the future of business life in respect to leadership and management. The author explains this effect through decision-making role, interpersonal role and information processing role defined by Mintzberg. Besides he discusses how technological developments change skills required for not only managers but also employees in the present and future as well.

In Chapter 11, "Critical Successful Factors in Enterprise Resource Planning Implementation", the authors present a research and try to explore the perceived critical success factors in the implementation of ERP system from fifteen IT professionals and administrators in a Phoenix company. They design the research based on strategic critical success factors such as top management commitment and support, visioning and planning, project champion, implementation strategy and timeframe, vanilla ERP, project management, change management and managing cultural change and also tactical critical success factors such as empowered decision makers and BPR and software configuration. This chapter would assist leaders of the organization to make better decision regarding the ERP investment and implementation.

In Chapter 12 titled as "Application of Utility Mining in Supply Chain Management", utility mining is used to find profitable items. Further, the loss profit is calculated for each item. Thus, inventory manager can focus on beneficial things and keep up required stock. The learning acquired from such beneficial happening items can be utilized by a grocery store to overhaul the format of the store. This builds the benefit by setting interdependencies items close to each other and henceforth fulfills clients through sparing time and helps in supply chain management. This model will fill the gap in the implementation of technologies in Industry 4.0 within the supply chains.

Chapter 13 is titled as "Digitized Public Administration: Using Gamification to Introduce Innovation" and it focuses on the change public administration is undergoing throughout the digitization process. Being bound to laws and political guidance, public administrations are less flexible to adapt to new changes than privately held companies. However, public administration still needs to motivate its employees just like private companies have to. To do this, different strategies have been suggested. This chapter attempts to highlight common challenges and possible benefits of using gamification techniques in enhancing motivation in public administration.

Chapter 14 titled as "Industry 4.0 and Its Effects on the Insurance Sector" focuses on the transformation of the industry 4.0 in the insurance sector and assume that this transformation will be most prominent in the calculation of insurance premiums, in the prevention of insurance fraud, in the digitalization of insurance distribution channels, in providing the best insurance service to the insured. Besides that explanation of industrial revolution, the historical development of Industry 4.0 and the interaction of

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the insurance sector with Industry 4.0, the chapter tries to answer how machine learning, the internet of objects, artificial intelligence will affect the insurance sector.

With Industry 4.0, the workforce and the training and educational systems will be also impacted. Chapter 15 titled as "Future of Education in Industry 4.0: Educational Digitization and Its Impact on Communication – A Canadian Case Study" presents a study, whereby those new competencies and skills will be researched, and recommendations given as to the required changes in the higher educational system. The authors observed that today's students' digital literacy and dexterity will be the main mechanism that will empower organizations to utilize upcoming critical digital developments. The demand for these skills and qualifications will undeniably be higher when compared to the present. This will result in the need for changing and adapting the existing curricula and the tools used in the existing educational system which will equip students with the essential employability skills required to remain competitive in Industry 4.0.

The book has turned out to be a valuable compilation of current analysis and futuristic assumptions on business and communication in Industry 4.0. We value the work of the scholars that have collaborated with us in this book for the international and interdisciplinary perspective they have brought.

To conclude, this book presents several aspects and futuristic assumptions regarding changes in business management and communication perspectives that are to be adapted to Industry 4.0 and its related issues. We as the editors hope to give you some valuable insight regarding Industry 4.0 and the business and communication-related matters of the future.

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Chapter 1
Digitalization Strategies in the New World Order:
A Conceptual Study to Understand Digitalization Strategies

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ABSTRACT

Digitalization in organizational context enforces organizations to define their own strategies. In this sense, organizations make their choices from a variety of digitalization strategies from IT strategy to digital orchestration strategy. Organizational digitalization, their digitalization capabilities, and transformations that they have experienced define their routes in the digitalization process. Thus, the purpose of this chapter is to present digitalization strategy choices mentioned in the business management literature through examples.

INTRODUCTION

For all organizations, the importance of resource dependence and transaction cost theories sharply rise in the new world order. Triggering effect of trade wars, fluctuations in both national and international economies, movement of the workforce and capital, development of new technology enforce governments to make strategic decisions to sustain their national competitiveness. The great economic collaborations among countries such as NAFTA, EU etc. are no longer itself a competitive power source while these relations among nations are becoming more fragile. Capital movements as an important factor in the world economy, are in search of more secure harbors where they can get greater benefits. All these changes put a remark not only on governments but also on companies where resource dependence is greater and cost-based competition is higher.

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In this competitive world, organizations are dealing with the problems of technology adaptation. Automation systems, enterprise resource planning systems, and business process management systems are examples of core areas in technology adaptation process that many companies have put their concentration on. Results are the minimization of the workforce but maximization of talented ones and minimization of costs in internal and external transactions. Digitalization efforts for many organizations have already started years ago. But what puts digitalization more in focus today is the existence of aggressive global competition and the increasing global risks.

Digitalization cannot only be linked with the encoding of information. Yoo et al. (2010) state "digitalization goes beyond the technical process of encoding information in digital format and involves organizing new sociotechnical structures with digitized artifacts". Digitalization should also be related to creating knowledge. With the knowledge, digitalization of organizations enables them to show more adaptive behaviors in markets by decreasing costs, decreasing inaccurate product and service rates by digitizing information and recruiting more talented workforce.

BACKGROUND: DIGITALIZATION

Even digitalization is talked much among organizations, how they can be digitalized is still a question mark. The prior issues for organizations to decide are "what really digitalization means for them", "what are the needs for digitalization", "what are the capabilities of organization for digitalization".

Not every organization can be digitalized. Organizations may not even need digitalization. It is necessary for an organization to define very carefully what outputs it expects to achieve in the context of digitalization. Sometimes it is possible to achieve organizational goals only by improvements on the IT system or IS system without a high level of digitalization. For this reason, digitalization should not be seen as an application that provides automation or data recording. Organizations should be aware that digitalization can bring high costs to the organization. If the emerging costs do not cover the investment, digitalization may not be the right choice for the organization. However, it should be kept in mind that even the steps toward digitalization create costs. Taking new steps with the help of learning and experience curves in the digitalization process can create advantages both in terms of cost and time.

IT Strategy and IT infrastructure can sometimes be seen as business strategies. Within the IT infrastructure, there are factors affecting digitalization.

Data collection: Although the importance of data collection in an organization is important, the quality of data collected, processed and stored is becoming more vital for digitalization practices. In the context of system analysis, the problems are encountered in the determination of the data generated areas, sources of data (autonomous systems, semi-autonomous systems, manual systems), data collecting sensors (autonomous / non-autonomous), transmitters (labels / barcodes / QR code) and so on. "Smartization" is the critical concept behind the importance of these data generating areas. Smartization of products are also increasing competition among firms (Porter & Heppelmann, 2014, 4). The data transmitters' calibrations and error frequencies, and the software and hardware capabilities of the registered IS systems affect the data quality. Any decrease in data quality quickly can reduce the confidence in digitalization and increases the resistance of the staff to digitalization related applications. According to the study in Deutsche Bahn, Ehmke (2017: 181) also points the risk of information loss and states aggregation and disaggregation of data must take place on many decision levels.

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Compatibility of IT systems: The incompatibility of data creating nodes with the existing IT system can cause problems in data collection. In particular, in gathering machine data (based on IoT, PLM, etc.), machines and systems can need technological improvements. However, if these investments have an effect on the machinery systems, attention should be paid to data management collection methods within the scope of digitalization. With a triggering effect change can cause unexpected incompatibilities with the systems that can create high costs.

Talented Workforce in IT/IS: With the increasing level of digitalization, the organization may need IS and IT staff with different qualifications and competencies. The gap in this field is sometimes closed with the recruitment of new employees from outside or through the development of existing employees. Another method used is to outsource IS and IT management partially or integrally.

Cost-benefit curve: Another point that organizations should take into consideration in the context of digitalization is the return on investment and the alternative gains of the investments subject to cost.

Achievements in the context of digitalization: The IT investments carried out for digitalization and the perceived success of application will also determine the support and resistance of the employees to change. According to Kirchmer et al. (2016), based on their survey on approximately 200 companies from all around the world, top ten successfully completed digitalization initiatives are respectively social, cybersecurity, cloud, process automation, mobile, production automation, analytics/ predictive analytics, digital marketing automation, multi-channel integration, and internet of things (IoT).

Beside IT capabilities, workflows in terms of management of business processes also play a vital role in digital capabilities of an organization. In this context, how accurately the business processes of the organization are defined and how it is up-to-date influence the management of digitalization. A periodic configuration in any of the business processes will affect the efficiency of the processes in relation to digitalization. There are separate priorities of managers and employees in relation to digitalization of business processes. The other party is the external stakeholders of the organization. A digital communication strategy with stakeholders can manage organizational concerns. This would be a comprehensive strategy to secure organization.

A good example of digital communication strategy is given by Chen et al. (2017: 11). Their study draws attention to Citigroup collaboration with a Mexican Bank developing a mobile payment platform. Digital platforms in this regard could be useful to manage the relationships with the stakeholders.

In another study, Lenka et al. (2017) define digitalization capabilities as intelligence capability, connect capability and analytic capability. Through these capabilities an organization by using hardware through communication can create valuable knowledge. When these capabilities work simultaneously with one another then digitalization could be effective.

Being aware of digital capabilities will make organizations aware of how much digitalization efforts are manageable. For organizations in the digitalization process, awareness in this context will help them to design their path to the level of digitalization they want to achieve, which can be characterized as the digitalization gap. The digitalization journey of an organization can be defined as a digital transformation.

In this transformation process, one important question for organizations is the decision of the organizational level of digital transformation. When the digital transformation is analyzed from the organizational perspective, Parviainen et al. (2017: 64) state digital transformation can be seen at four different levels. These levels are defined as:

- Process level: adaptation of digital tools
- Organization level: new services and offering existing services in new ways

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- Business domain level: building value chains between organizations
- Society level: effect on the society

In this transformation the fit and harmony between different levels and types of strategies (such as transformation strategy, IT strategy, IS strategy, production strategy etc.) become crucial. Thus, a strategy mapping perspective (Kaplan & Norton, 2000) might be a useful tool to use to find out the conflicting issues in this harmony.

DIGITALIZATION STRATEGIES

An accurate understanding of digitalization strategies depends primarily on the understanding of how these strategies emerge. Development of digital technology (IoT, Cloud computing, etc.) has created disruptions of business models (Pagani, 2013:617). Thus, technology change became the main trigger of digital technologies to evolve.

As new digital technologies emerge, different usage of these technologies is discovered. In the perspective of efficiency, the first steps of digitalization, such as automation, has been more common in production. Although production function enables digital technologies a larger area of use, it has been realized that other organizational functions can also be managed more effectively with the help of these emerging technologies. Today, we see an enormous quantity of data managed under the name of big data, processed in meaningful outputs and used in the scope of strategic management. And these outputs of digital business strategy are used for strategic decisions in rivalry (Mithas et al, 2013: 513).

IT Strategy

IT strategy has special importance in digitalization. At the core of digitalization, the existence of information systems and data management ensures that the IT strategy is more integrated with digitalization. In this sense, the IT strategy can be seen as the "fusion" of information technologies and business strategy (Mithas et al, 2013: 513).

Organizations can sometimes face arising problems based on their IT strategy. One of these problems in this context is the implementation problem. Gottschalk (1999: 113-114) in his implementation matrix points the resources needed, user involvement, analyses of the organization, anticipated changes in the external environment, solutions to potential resistance, information technology, projects' relevance to the business plan, responsibility for the implementation, management support for the implementation and clear presentation of implementation issues as items.

The resource dependence experienced during the implementation of IT strategies is another problem. In the implementation phase of digitalization increasing costs may stretch or in some cases deactivate the project. The implementation may not provide the expected efficiency due to prolonged time. Resource dependence in some cases is the need for talented workforce. At this point, the excessive workload on the personnel may increase tension in the organization. Another important issue on employees is the problem of adaptation to innovations that are introduced to the organization within the IT strategy. In addition to the software and interfaces used by the current personnel in the IS, the initiation of new applications that did not exist before is one of the conflicting issues due to the learning need and the

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experience curve. Another conflicting fact on implementation may arise from external conditions. Due to the changes in the external environment (economic crises, termination of the services of IS providers, etc.) problems can be seen as disruptive factors in the adaptation process.

Information based capabilities are tangible and intangible processes which are firm-specific (Amit and Schoemaker 1993: 35). Thus, they cannot be fully transferred to another organization. IT capabilities have limited transferability. Although organizations want to benchmark IT practices from their organizations to other organizations there will be differences in operations based on the capabilities of each organization. So, the chance of success of such an organization will be different. Even if the human factor is minimized by increasing the level of digitalization within these capabilities, there is a need to create interfaces in which the employees can be coordinated with organizational digital applications. In this sense, it is necessary to determine the level of compliance with the institutional capabilities in relation to the duties of the employees in these interfaces.

Investing in IT also requires a strategy. The organization can decide to invest directly on itself to strengthen its IT capabilities or can outsource its IT regarding complications it faces.

General IT Investment Strategy

Mithas et al (2013: 513) believe IT Strategy cannot be seen as a functional strategy and IT and business strategy should be considered together. The content behind this belief lies deeply with the digital content of the information technology. The introduction of digitalization strategies cannot be independent of information technologies. In any case, IT or IS based applications or supporting processes are involved in digitalization process. Digitalization can focus on tangible elements (robotics, automation systems, conveyors, digital communication applications, etc.) or directly on IS / IT infrastructure development.

IT Outsourcing Strategy

Making IT investments can put down enterprises financially within the scope of digitalization. This situation may sometimes cause enterprises to substitute IT investments for leasing or outsourcing instead of direct investments. The high ROI ratio can result in the loss of top management support in the realization of this investment. Although the strategies of the organization play a role in the investment decision point, the final decision is generally the financial dimension of the investment. For this reason, outsourcing is an important strategy in the context of digitalization in order to show both financially as expense items and to decrease the negative effect on working capital in the short term.

Another reason why outsourcing is the reason for preference is that the investment to be made does not meet the minimum investment capacity. In cases where the fixed investment cost of the system in which the capacity is low or will be established is very high, the cost per production or service can be realized at a very high level. This situation adversely affects the profitability of fixed capital investments. Such situations can also lead to the focus of IT strategy on outsourcing.

Another important situation is the speed of technology change. The high expectations for technology change and the expectation of an increase in performance variables such as production or service capacity may cause the investments to become meaningless for the organization in a short time. Therefore, outsourcing can be used as a digitalization strategy at certain points in order to provide flexibility in the renewal of the technology used depending on the speed of technology change.

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Another topic, agility underlies firms' success through value creation through services and channels (Sambamurthy et al; 2003: 238). Thus, IT competence of the organization plays a vital role in digitalization and agility.

Digital Servitization Strategy

Servitization is defined as "a mechanism to add new value to products by adding services" (Vandermerwe & Rada, 1988). Today, servitization is changing with the effect of changes in technology and digitalization. Beside digitally integrated services, new business models are also arising which are directly based on digital services. Digital services (e.g. Netflix, Uber) and smartization of products (e.g. box.com, Intel's smart shelf) are common forms of usage in this strategy. Digital servitization is defined as "the provision of digital services relying on digital components embedded in physical products (e.g. e-book, smartphone, tablet)" (Vendrell-Herrero & Wilson, 2017: 4).

The question for organizations is how many components a product/service can possess and another question is if there is a necessity of digital components in a product/service. The fact is many products are integrated with digital services with the help of innovation and increase the quality of life. The answer of why digitalization is so much discussed is hidden at the consumer preferences (B2C) and industrial needs (B2C). New features embedded in products in terms of servitization have an effect on the quality of life (e.g. Apple Watch Series 4 by adding its components to measure cardiological data such as ECG which has already saved lives). In B2B applications, features on servitization added to products can facilitate product-related operations in different ways (e.g. in maintenance process, computer-based diagnosis systems give very quick diagnostic feedback by using sensors embedded in automobiles). Mathieu (2001: 57) suggests that new service additions will be focusing on the client. In this aspect what will be expected from digitalization is to put people more in the front than the product or service. Digitalization in terms of servitization can be seen also in different ways. As an example Lenka et al (2017: 92) give rental agreements instead of selling trucks.

Servitization by means of attracting customers, satisfying their known and unknown needs, tries to benefit from the development of technology through innovative ideas. Vendrell-Herrero et al (2017: 70) define the advantages of servitization as:

- Consumer interaction
- Interdependence with content producers
- Existing advanced payment systems
- Cost and price minimization

But of course, the complexity of services will influence the degree of digitalization (Lerch & Gotsch, 2015: 45). Here the organization will need support mechanisms such as information communication technologies in terms of customer interactions, content producers, advanced external systems etc. As digitalization in the organization becomes manageable the expected success will influence the competitiveness of the organization.

Competition among companies pushed them to new quests which will help them to survive in the markets. Digital services in servitization are becoming one of the quests they can depend on. Even though there might be traditional products, a substitute for these products (Greenstein, 2010) in terms of digita-

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lization could become a criterion to choose. Therefore, adding services can be an opportunity to satisfy unmet customer needs gaining a reward of sustainable competitive advantage (Lenka et al, 2017: 92).

It is seen that especially production-oriented enterprises are in search of improving their sales and after-sales service operations. The competing issue is co-creation of value with the customers. In value co-creation process interaction is vital for the organization. How the interaction between the customer has been established and how the customer's behavior changes. However, it should not be forgotten that only servitization cannot improve performance (Cenamor et al., 2017: 55).

Servitization looks like a profit accelerating and market supportive issue. In reality, it can arise a paradox for organizations. Gebauer et al. (2005: 55) define service paradox as a major challenge in servitization, which leads many firms to increase revenues while reducing profits. Servitization also needs investment which will result in additional investments and operational costs. The important fact here is ROI and market effect of these attempts. As discussed in digital capabilities sometimes it is better to wait instead of making a quick attempt on digitalization.

In general, the concept of IoT and Industry 4.0 often discussed jointly (Wortmann & Flüchter, 2015). IoT has also effects on servitization strategies in which changes organizations' position in value chains (Rymaszewska et al., 2017: 92).

Digital Distribution Strategy

Another strategy that organizations may prefer in the context of digitalization is "digital distribution strategy". This strategy is based on the use of the advantage of managing a specific distribution channel. The most common application examples in this area are seen as Software-as-a-service (SaaS). The reproduction and distribution of SaaS's are very easy when compared with the physical products. Anyone who owns SaaS as a product can market it in the distribution chain due to easy reproduction and redistribution (Feng et al.,2009: 242). Especially digital contents are very good examples that can be easily distributed.

The base of SaaS can be found first in Infrastructure as a Service (IaaS). The increasing technology on cloud services and putting the units of computing power and storage in an on-demand service as cloud services (Oliviera et al, 2014: 498) increased the capability of SaaS providers. SaaS/Cloud has couraged IT vendors creating a platform to assemble preconfigured application components (services) dynamically into custom, integrated application suites (Lehmann, 2012: 148). The support of speed and infrastructure of SaaS has led to the adoption of the digital distribution strategy and the transformation of some industries to digital. Research on performance results of execution times between real machine and Windows Azure Cloud Service showed a very small difference in integer sort, block tridiagonal, lower and upper triangular tests (Roloff et al., 2012). But in another aspect pay per use and speed are the important dimensions that affect the preferability of IaaS with an effect on SaaS.

Why SaaS is becoming so popular? The answer lies in a very important complementary service, the Internet. As the speed of the Internet is increasing, to transfer a huge amount of data is becoming possible.

This situation has enabled the use of existing software and the newly developed ones which could not be used because of the boundaries in IT infrastructures. SaaS-enabled the use of web-based software programs without any installation. So users can directly work on these software programs from a workstation, computer, tablet pc, mobile phone and so on by connecting to the Internet. Some organizations have benefited by adapting their technologies with these services while some decide to stand still.

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According to the study of Park & Ryoo (2013: 166) expected switching benefits has positive effect on the intention to switch. Thus, the expected future benefits with switching costs will be taken into account. In the usage of SaaS, there are still differences in organizational preferences. Most of the organizations need cloud-based services suitable and adaptable within their internal processes and infrastructure. Especially due to legal pressures and excessive affinity in industries, it may be thought that there is a tendency towards SaaS use in more stable applications. Regardless, organizations will either develop their own solutions that are compatible with SaaS's at specific points, or they will enable the creation of customizable application platforms that will integrate the applications they demand into SaaS. Today, the most common use of ERP solutions in the world are providing support at specific points to develop customized applications for organizations. Of course, cost dimension in the development of these solutions will affect the organizations' acceptance rates of these solutions. Future of digitalization and Industry 4.0 give the clues of the future workforce to be capable of algorithm logic and develop their own solutions with user-friendly interfaces. (Even today drag and drop logic-based applications are started to be used)

Today SaaS is mostly seen in on-demand service model and needs a low level of customization (Benlian & Hess, 2011). This situation, of course, is a barrier for organizations that need more customized solutions. Other important issues are agility (Oliviera et al, 2014), IT efficiency (Oliviera et al, 2014), High installation costs (Chou & Chiang, 2013), potential costs linked to discontinuance (Chou & Chiang, 2013), perceived usefulness (Chou & Chiang, 2013), trust between parties (Chou & Chiang, 2013).

From another aspect, some organizations are aware of cloud-based SaaS solutions. Oliviera et al. (2014) summarizes the disadvantages in this process. When an organization perceives the solution as a disruptive technology, the solution may not have conformity to standards, organization may not have technology readiness, there may be competitive pressure on organization, there may be trading partner pressure, and there may be not enough perceived benefits and there may be high risk and costs. Beside profitability concerns, based on the number of application users in the organization, cost of infrastructure to perform the system, the maintenance cost of the system, and cost of technical staff responsible to perform the system should also be added to Oliviera's list.

The complimentary risk about protocols, API's, software, etc. regardless of service providers should also be considered. Changes in the user conditions, additional costs, termination of support could create unwanted consequents about the usage of SaaS. "Java" case in recent years is a good example where some features and versions of Java support needs corporate membership that creates additional costs for organizations.

Copyright problem is one another issue when it is hard to protect intellectual property rights. Instead of protective policies, in some cases, dissemination of service brings the organization a competitive advantage. Netflix CEO Reed Hastings's speech on "It's Okay to Share Your Account" (http://fortune.com/2016/01/11/netflix-hastings-account-sharing/) is a good example to gain competitive advantage. He states when people share their username and passwords this should not be perceived by the company a problem. In the end, everyone will ask for customization and personal privacy concerns will also keep them to have their own account. But sharing will also affect new users to become members. In this loop, the company will be the winner.

Digital Value Innovation Strategy

Porter (1985) defined his generic strategies as cost minimization, diversification, focused cost minimization and focused diversification. In diversification and focused diversification one main way to realize

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it is to add value to the product or service. But the expected does not always happen. So, the toughest part to create value is to find the right value proposition.

In digitalization perspective value innovation, with the acceleration of technology, had a new meaning. The increasing importance of data management, a possibility of working with big data, the availability of digitally connected world has started the era that we call "the digital era". This new era is carrying the search for value through technology and giving birth to new digital companies. According to the Fortune list (Fortune 500 as of 5/21/2018), four of top five most valuable companies list is formed of technology companies. But according to revenues in 2017 in fortune top ten list there are no technology firms (http://fortune.com/global500/). This is another dilemma that we face. What's happening here is the value creation has a very powerful effect on the company values. People have expectations and expectations from technology firms are new products or services related to digitalization.

Because of the intense competition, cost-related issues enforce organizations to innovate. This is how Prahalad & Ramaswamy (2003) stated the need for innovation.

All around the world knowledge workers are increasing, investors are also in search for low ROI rates. All these elements today points technology firms to be the shining stars of the world economy. Geiger & Sa (2005: 4) state the new emphasis is built on high technology industries, industrial and academic clusters, and start-up firms with policy upon technology creation. Innovation is the main trigger for these organizations and even there is high support to these players in a local, national and global basis, they face different boundaries.

At first sight, the main aim of innovation seems to develop new markets through the discovery of new products or new services that will meet consumer needs. However, the point we have reached today has put forward the importance of value innovation far beyond all these. Value innovation can be executed in innovative products, services or processes. And more of this can be found in blue ocean strategy defined by Chan Kim & Mauborgne (2005), stating value can be created by differentiating an existing value than rivals' have. Furthermore, Prahalad & Ramaswamy (2003) have also defined the concept of experience innovation and argued that companies and consumer communities acting in a particular network can co-create value for individual customers.

Within digitalization experience innovation aims to develop suitable products and services for customers by benefiting from customers' experiences (Prahalad & Ramaswamy, 2003: 17). Today, many software request feedback from consumers like bugs etc. The aim is to further improve the system and increase customer satisfaction. And there are also disruptive innovations (Christensen, 1997) some of which becomes industrial standards. In 2018 with the increasing trend in coin mining, AMD RX cards are suddenly sold out. Ones that could be found in the black market have been sold 4-5 times more than its current price where this card became the coin mining industry standard.

Digitalization and Industry 4.0 also have affected engineering-based companies. With technology cross-fertilization, general purpose technologies increasingly started to become intelligent (Björkdahl, 2009: 1469). The enterprises have started to gain new qualities through the adaptation of new technologies in their existing machinery and equipment and have created new value creating systems. Knowledge Management technologies are also used in value creation that adds strategic value (Saito et al., 2007: 101)

The effort to create value with intelligent technologies and digitalization has led digital innovation concept to arise. Digital innovation is defined as the use of digital technology during the process of innovating (Nambisan et al,2017: 223). In another definition, Yoo et al. (2010: 725) state digitization make physical products programmable. This situation makes it possible to make innovations that can be reprogrammed and which can be developed in terms of both electronic, mechanical and software. Of

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course, in carrying out this type of innovation, the level of technology (digital technology) in the hands of the organization and the level of manpower to activate this technology is important. From another aspect digital technology also provides opportunities for incumbent firms (Nylen & Holmström, 2015: 59).

An important question to organizations is should everything be digitized? In fact, today, when we talk about products, e.g. boilers with remote internet access can warm your house before you came. But still, there is a question if it is safe to open it when there is no one at home? Or the example of refrigerators that give orders from the internet. When the basic food items reach the critical stock level in the shelves, automatic ordering process starts. What if we're going on vacation and if we didn't define this information to the refrigerator? Thus, we are also experiencing risks of digitalization.

If digital value innovation is considered in terms of machinery and devices, first the integration ability of these devices and machinery with digitalization within the scope of the device layer should be determined. Besides the physical elements, the possibility of programming which can be defined as logical and communication capabilities within an IT infrastructure (networking, IoT etc.) should be determined.

Platform Strategy

With the development of technology, the desire to introduce more qualified products and services has forced the major players put important steps to be the leader in products or services. Digitalization has important implications for the implementation of prototypes especially in software and high technology products. It is almost impossible to reveal all the parts of a product by the same organization. One main reason lies in the perspective of economies of scale. Outsourcing and purchasing are basic solutions to supply needs. But it is a strategic decision whether the other needs will be revealed by the organization depending on the capabilities, capacity and value created. Within the scope of risk management and knowledge management, some parts may be produced independently by the organization itself.

However, it is inevitable to cooperate with other organizations. For example, a computer manufacturer cannot manufacture all components (processors, HDD, Ram, display board, keyboard, touchpad, data input-output ports, electrical systems, motherboards, coolers, etc.). With a platform strategy, the leader organization tries to make others dependent on itself with cooperation. By time platform leader forces others to make progressive improvements to stay on the platform. In this way, while those who keep up with this change remain in the platform, and new organizations that can keep up with the change will be replaced by the dismissed.

Cenamor (et al., 2017: 55) states "platforms facilitate interactions and allow firms to distribute responsibilities based on the competitive strengths of each participant". Cusumano & Gawer (2002: 52) show Intel as a leading example in platform strategy. In every 18-24-month period, Intel doubles its processor speed and led the platform members to keep pace with itself.

In their spider web model of platform leadership, Lee et al (2010: 98) define innovative ability, network effect, efficiency, complementaries, and connectivity as five pillars of platform leadership. Besides these five pillars in the success of platforms, value to service providers as adopters, value to end users as adopters and platform quality are also important (Ruutu et al., 2017: 129) dimensions to be added. It's not easy to keep the platforms and keep as platform leaders. Cusumano & Gawer (2002: 52) stated platform leaders face three major problems:

- To maintain the integrity of the platform
- To let platforms evolve technologically

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- To maintain platform leadership.

One impact on platforms is the controlling of different layers of the platform by different players. In this case, the platform leadership will be unstable while it can disrupt the buyer's value proposition (West, 2003: 1261). Gaming industry might be a good example. While there are different game console producers and game producers. The platform leadership shifts between the console producers and game producers. When a specific game becomes favorite among players if not all consoles are supporting it the game producer becomes the platform leader expecting faster processors, higher internet bandwidths, better graphics cards from console manufacturers. The reverse effect happens also when console manufacturers produce better equipment that forces game producers to use higher technologies.

Digital Orchestration Strategy

As digital platforms evolve the need of a dominant firm arises to make the market sustainable. Iansiti and Levien (2004: 82) talk about Microsoft, Wal-Mart and eBay as regulators in their business ecosystems which they also defined as keystones. Keystones are organizations to maintain the health of the ecosystems. An important question is how these keystones appear.

The need and satisfaction are two important concepts and the third concept is innovation. Customers sometimes may not know what their need is while the satisfying good/service is not invented or served yet. Here with the effects of innovation and digitalization, we see digital orchestration strategy.

Uber is given as a good example for digital orchestration. Deep learning capabilities made Uber solve the equation between the problem of consumers (to be able to travel a customized solution with affordable prices) and the drivers (people owns a vehicle and would like to earn money at their spare time) (Nambisan et al, 2017: 231). More orchestration examples are Spotify (between music players and listeners) and Foursquare (People wants to do something outside and small business owners who want to show what they serve). In fact, there are plenty more like Reverb LP (vintage physical music media owners and buyers), Soundcloud (music makers and explorers).

Nambisan et al. (2017: 23) take the attention of increasing crowdsourcing and crowdfunding systems on digital platforms that support innovation orchestration. Orchestra model involves a group of firms coming together to exploit a market opportunity based on an explicit innovation architecture that is defined and shaped by a dominant firm (Nambisan & Sawhney, 2011: 41). "A hub firm's orchestration activities occur in a dual context—an innovation context and an interfirm network context." (Nambisan & Sawhney, 2011: 40)

FUTURE RESEARCH DIRECTIONS

As digital tools evolve and technology becomes more accessible, more organizations are trying to get involved in the digitalization process. Even in public management increasing number of efforts are seen in terms of digitalization of work. All these efforts show that new fields will appear in the near future which will be influenced by digitalization. Thus, author's idea on future research areas would be shaped under the topics of the effectiveness of the tools used in digitalization process and their effects on the organization for internal processes, effects of digitalization on employees, problems and conflicting issues in digitalizing organizations, and financial aspects on digitalization with the support mechanisms.

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Even though these fields stated above should be considered in the future research areas, deeper understanding about the strategies is needed to be revealed. For this purpose, intense case studies are also a need to understand the field.

CONCLUSION

The main aim of this chapter is to give a holistic understanding of digitalization and digitalization strategies. For this aim, digitalization strategies are explained based on the literature review. With industry-based examples, it is tried to be explained how these strategies are shown. Organizations aim to get digitalized should focus first on their IT strategies. In order to do this, organizations should review their corporate and functional level strategies, should try to define the compatible and conflicting parts with IT strategy. Strategy map could be a supportive tool to find out and discuss mismatching strategies. After all, an IT infrastructure harmonized with information systems will be a good start for organizations. Focusing on more advanced digitalization strategies such as platform strategy will not guarantee the success of an organization. The right fit between the strategy and organization with competitive comparisons will increase the probability of success.

Organizations that are more competent in digitalization can focus on more advanced solutions. Benchmarking from the industrial examples would be beneficial to find the possibilities in digitalization. Also, the blue ocean approach to defining new value propositions may be a useful approach for organizations. It should not be forgotten that corporate-functional-digital strategy fit with organizational structure and IT/IS integration is vital in the end.

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KEY TERMS AND DEFINITIONS

Digital: Issues in which electronics and computerization is embedded.
IS: Knowledge creating systems linked with information technologies.
IT: Data transmitting and processing units consisting of hardware and software.
Orchestration: Coordination of digital systems.
Platform: A common area for anyone in digital collaboration.
Servitization: Digitally supported service.
Value Innovation: Creation of a unique value within an intersection of cost and value dimensions that creates competitive advantage.

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Chapter 2
Understanding Digital Congruence in Industry 4.0

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ABSTRACT

Industry 4.0 is a type of revolution that brings profound changes around the world. Industry 4.0 has both broadened the scope of digital transformation and raised its importance to organizations. The interconnection of digital and physical processes is fundamentally increasing. In this respect, digital transformation becomes a major driving force of Industry 4.0 for organizations. While Industry 4.0 presents key opportunities to boost competitiveness and promotes digital change, development of digital capabilities is significant for organizations to be better prepared to implement these advances. Thus, according to some authors, digital capabilities refer to digital congruence. Digital congruence relates to culture, people, structure, and tasks in organizations. It is therefore considered that explaining the link between digital congruence and Industry 4.0 will provide a unique insight into the research agenda of Industry 4.0.

INTRODUCTION

Today, the digital change which is happening at an exponential pace, is dramatically affecting us. According to Klaus Schwab, we are at the beginning of a revolution that is fundamentally changing the way we live, work and relate to one another. This revolution, Industry 4.0 is characterized by a range of new technologies that are spreading around the world by impacting all disciplines, economies and industries. Rapid technological advances with new ideas make Industry 4.0 unique and these profound advances highlight the potential to connect billions more people to digital networks (Schwab, 2016). Transactions are being digitized, data is being generated and analysed in new ways, people and activities are connected (Iansiti & Lakhani, 2014). While the role of digital technology is changing, digital transformation provides opportunities for value creation and capture. The strategic implications of these changes are indispensably critical for organizations (Digital Transformation of Industries: Digital Enterprise, 2016). With the changes being so profound, adopting and implementing Industry 4.0 present

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a special challenge for organizations throughout the world. German Trade and Invest (GTAI) defines Industry 4.0 as the technological evolution from embedded systems to cyber-physical systems, an approach that connects embedded production technologies and smart production processes (MacDougall, 2014). Incredible progress of digital technologies becomes important and transformational for organizations. The transformation that has been brought about by digital technology is extremely beneficial because technology provides more choices (Brynjolffsson & McAfee, 2016). Industry 4.0 encompasses digital transformation of organizations around the globe. In other words, Industry 4.0 has both widened the scope of digital transformation and increased its significance for organizations. Industry 4.0 combines digital and physical technologies-artificial intelligence, Internet of Things, additive manufacturing, robotics, cloud computing and others, to foster more adaptive and interconnected organizations (Hagel, Brown, & Lui, 2013). Digital transformation can be defined as adopting business practices that help organizations to sustain their competitiveness. It is about how organizations adapt to digital trends as well as adapting to how customers, employees and competitors use digital technologies (Michelman, 2018). The ways organizations use digital technologies to drive their businesses forward are crucial to successful transformation. Thereby, using technology better than their competitors do, is important in building a digital advantage for organizations. While digital technologies are tools for organizations to transform their business processes, excelling in different dimensions play an important role in transforming digitally. Sustaining the momentum of digital transformation is crucial to the long-term success of organizations. In order to make the change possible, building new skills is necessary for organizations. Digital transformation demands integrating technology and business processes (Westerman, Bonnet, & McAfee, 2014). Moreover, the focus of digital transformation is both about strategy and new ways of thinking. Transforming for the digital age requires organizations to improve their strategic mindset and having a broader scope of business strategy (Rogers, 2016). In order to remain competitive, transformation efforts of organizations should be well designed.

Acquiring the right capabilities plays a crucial role for organizations to better prepare for their digital future. MIT Sloan and Deloitte recently examined how organizations can prepare for and survive the digital future. In their study, emphasis is given to development of digital capabilities, in which organizations' activities, people, culture and structure are compatible with a set of organizational goals. These digital capabilities refer to digital congruence. In the competitive landscape, organizations should consider a new concept which is called *digital congruence*, -culture, people, structure and tasks- aligned with each other and organization strategy and challenges of digital environment (Kane G. C., Palmer, Phillips, Kiron, & Buckley, 2016). The Congruence Model developed by Nadler and Tushman in the 1980s suggests, organizations to be systems that are made up of components or parts that interact with each other. The model is based on how well components fit together; that is the congruence among the components (Nadler, Tushman, & Hatvany, 1982). The Congruence Model is a powerful tool in order to analyse how well the key components of an organization interact. This means, organizational success depends on how the four key components -tasks, people, structure and culture- work well together. For instance, with a bureaucratic organizational culture, decision-making approaches will be problematic even if the organization follows the latest digital trends. The Congruence Model provides a framework for analysing organizational components in today's digital age. By adopting the four components as digital congruence, culture, people, structure and tasks as seen in Figure 1; organizations may able to compete the digital transformation driving Industry 4.0. Organizations will be able to benefit from the digital congruence thanks to the visibility which Industry 4.0 has given them. To remain competitive and successful in today's digital world, organizations should embrace the digital transformation Industry 4.0

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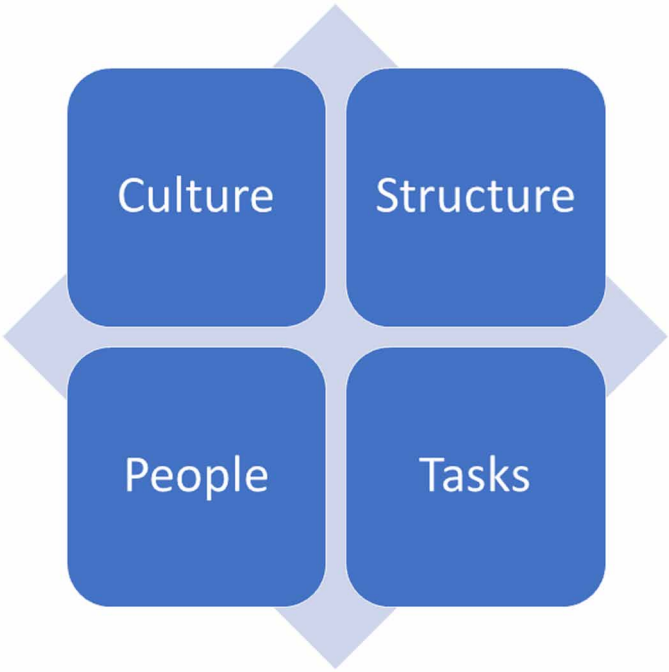
Figure 1. Digital Congruence Components.
Adapted from Aligning the Organization For Its Digital Future. MIT Sloan Management Review and Deloitte University Press.



offers. As digital transformation plays a crucial role within Industry 4.0, to understand the components of digital congruence is equally important.

Industry 4.0 continues to be at the top of the political and economic agenda of many countries in today's world. Industry 4.0 is a system of digital advancement which represents challenges and opportunities for organizations. With Industry 4.0, new forms of competition emerge, and the role of digital congruence becomes critical. Mastering Industry 4.0 requires a deep understanding of digital congruence; thus, it is a crucial avenue for research. In this study, it is aimed to examine this new concept "digital congruence" in detail in order to provide an understanding of it. The impact of digital congruence on organizations will be reviewed by expanding the breadth of the concept. Key challenges and the opportunities for Industry 4.0 deployments will be covered by integrating knowledge from various case studies.

CULTURE

Organizational culture refers to a system of shared meaning held by employees that distinguishes the organization from other organizations. The role of culture is important as it shows how employees perceive the characteristics of an organization. Culture has a boundary-defining role: It sets organizations apart from others. It inspires a sense of characteristic attributes or expected behaviours for employees. It represents common sets of norms for employees (Robbins & Judge, 2017). Culture influences employees' attitudes and behaviour by being a control mechanism (Weber & Dacin, 2011). Culture has significant

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influence on organizations. In this respect, Industry 4.0 has also implications on organizational culture while organizations adopt new processes that are key to their success in the digital age.

It is important for organizations to master the cultural changes necessary for digital transformation. The benefits of fostering a digital culture are substantial. Without a digital culture, it is obviously difficult for organizations to execute digital transformation. According to 2015 Digital Business Global Executive Study and research project by MIT Sloan and Deloitte, the ability to digitally transform the business requires a broader perspective of a clear digital strategy supported by leaders who promote a culture that is able to transform. Besides, what is unique to digital transformation is that risk taking becomes a part of digital culture (Kane G. C., Palmer, Phillips, Kiron, & Buckley, 2015). Strategy, leadership and risk taking are different factors that influence digital culture. All these factors have one thing in common: They support digital transformation. Thus, digital culture separates an organization from others and drives digital transformation.

A recent study emphasizes the importance of a true digital mindset along with the right digital culture. It is stated that without the right digital culture, the best talent wouldn't want

to stay in the organization. Digital culture depends on a digital environment which is highly collaborative with supportive leadership (Geissbauer, Vedso, & Schrauf, 2016). In addition, a culture leading to the implementation of a strong digital strategy is critical for organizations. In order to succeed in building such a digital culture, there are specific areas that have great impact. The first one is the active management support. Digital culture requires support from upper management as well as support for a digital flow between management and employees. Furthermore, a vision of organization's digital opportunities is critically important for leaders. The second area is about the interaction and collaboration in organizations. Digital culture helps to eliminate hierarchy between departments, functions and reporting lines. Instead, self-organized, cross-functional teams are created, and greater level of interaction is promoted in organizations (Bughin, Digital Success Requires a Digital Culture, 2017). Another important area is about risk taking. Digital culture encourages employees to take risks and to learn from failure. This type of culture fosters rapid decision making due to flatter hierarchy. Fast pace of work requires speed in a digital environment which is supported by digital culture (Hemerling, Kilmann, Danoesastro, Stutts, & Ahern, 2018). Overall, digital culture is one of the key elements of digital transformation. It is a reality that organizations are willing to invest in Industry 4.0 to enable digital transformation. An important part of this transformation is the cultural change in organizations. Adopting a digital culture is a key determinant of organizations' ability to digitally transform.

People (Employees)

Mastering digital transformation is a multi-level process and more than a technology transfer. While Industry 4.0 is evolving, it is an undeniable fact that the nature of work and employment has dramatically changed. Industry 4.0 represents a new kind of challenge for organizations as well as their employees. With the changing employee roles due to digital transformation and the emergence of new opportunities in Industry 4.0, it is to be expected that recruiting processes and career development become crucial. Some authors categorized the features that allow organizations to benefit from their employees into four, as being; skills, mindset and behaviour, talent sources and career development. As the need for skilled employees increases, it will be extremely important to develop new ways of attracting new talent as well as the adequate training programs for digital capabilities. This means, it becomes a necessity for organizations to provide their employees with resources and opportunities to develop their digital skills and

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capabilities. In order to determine these resources and opportunities, it is significant to understand how digital transformation affects the goals of an organizational strategy. By evaluating this circumstance, an organization can determine the necessary skillsets for its employees (Pillsbury, Geissbauer, Schrauf, & Lübben, 2018). Organizations success with Industry 4.0 is closely related to having employees with digital skills. It is a challenge for organizations to train existing employees and recruit new ones who have the necessary digital skills. The talented employees who are able to adapt and use the existing digital technologies are called digital talent. It is hard to find such digital talent for organizations that aim to successfully execute digital transformation. In other words, a digital talent gap exists due to the need for digital skills and digital roles in organizations.

There are various strategies for organizations to more effectively recruit, develop and retrain digital talent. It is extremely important that talent strategies are aligned with organization's goals. One of those strategies is to integrate digital talent into core business. In order to do that, many organizations create digital accelerator programs. The objective of these programs is to improve digital capabilities. Another strategy for organizations is to train existing employees. It very advantageous for organizations to train internal talent so that they develop new skills to adopt a digital mindset as well as digital tools. A third strategy is using bottom-up initiatives in order to find digital talent. Those initiatives include brainstorming sessions, suggestion boxes and competitions to determine potential employees and create ideas for digital solutions. If employees realize the importance of digital transformation and how they will benefit from the transformation process, then they will be willing to be involved in. Using these initiatives will help organizations to discover the digital talent they have (Dahlander & Wallin, 2018). Furthermore, organizations which understand the ways of dealing with Industry 4.0 technologies, need employees who require process and IT systems know-how in order to establish the link between the digital and physical world. Thorough understanding of overall processes, systems and data is a requirement for new business models and operational improvements in organizations. Thereby, data and process experts who can work at the interfaces between functions and systems, have become the talent organizations need (McKinsey&Company, 2015). Digital talent is one of the key components of digital transformation. For organizations, best practices of employment processes to more effectively recruit, develop and retrain digital talent gain importance. One of the factors that impacts organization's success is the quality of employees. Thus, skilled digital talent becomes critical in adopting and embedding digital transformation processes.

STRUCTURE

How organizations should be structured and the new skills required, are the prominent questions in the digital age (HBR, 2015). Smart, connected products are demanding organizations to revise and rethink, not only their strategies but also organizations' structures. Lawrence and Lorch address that every organization structure must integrate two basic elements, which are differentiation and integration. Dissimilar tasks, such as sales and engineering need to be differentiated or organized into distinct units. In addition, the activities of those separate units need to be integrated to coordinate and align them, in a timely manner (Lawrence & Lorsch, 1967). Smart and connected products of Industry 4.0 have a major effect on differentiation as well as integration. As a result, organizations' structures are changing gradually, and classic organizational structures are replaced by the new ones. New functional units and new forms of collaboration and integration between teams are emerging in organizations. These new kinds of units

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include unified data organizations, development-operations groups and customer success management units (Porter & Heppelmann, 2015). Therefore, organizations proceed to digitize in different dimensions.

For the most part, organizations are going through different forms of business transformations in order to adapt digital transformation in Industry 4.0. In terms of redesigning internal operating models, organizations take various tasks from business units and set them in new shared-service organizations. Product-oriented business units are reorganized by removing sales and marketing functions and placing them in industry or location aligned units. Tasks are also outsourced and moved to offshore units. In terms of control and alignment mechanisms, the decisions that are made at different organizational levels become in sync with the strategies of the organization. These mechanisms are modified for flatter, more collaborative work environments rather than formal organizational hierarchies for command and control. As a result of less hierarchy, collaboration gains importance which can be considered as a big organizational change. An example of this organizational change is the agile method which refers to alternative methods of working. Agile methodology involves multidisciplinary teams, continuous level of collaboration, short set periods to complete specific work, new roles like "scrum master" and "product owner". This methodology is different in concept from traditional ways of working and requires organizations to become more collaborative (Scantlebury, Ross, & Bauriedel, 2016). Besides becoming collaborative, organizations are forming their strategies around digital transformation. In order to take the advantage of digital transformation, differentiating strategies to support digital transformation gains importance.

What drives digital transformation is a clear and coherent digital strategy. The scope and objectives of the digital strategy are significant. Organizations may consider their future visions and work backwards from their visions in order to develop more advanced digital strategies. Thus, the traditional strategy development process is reversed instead of planning organization's next steps according to its present abilities. Digital strategies are developed with a focus on transforming the organization (Kane G. C., Palmer, Phillips, Kiron, & Buckley, 2015). Overall, one of the ways to successful digitization is related with the digital strategy.

Thus, capturing the full potential of Industry 4.0 requires a deep understanding of collaboration and a clear strategy. In order to benefit from Industry 4.0, organizations need to transform, which requires change in organizational structures. Besides, organizational strategy plays an important role in building organizational structure that sets organizations apart.

TASKS

Along with Industry 4.0, the way traditional workplaces function, has significantly changed. With the signs of the change, the emerging workplace suggests new perspectives. The key contours of this change are the workforce and the nature of tasks.

Industry 4.0 has a significant impact on the workforce and demands new skills. As the skill requirements change, it becomes harder for organizations to find the right talent. The extent to which organizations benefit from Industry 4.0 will depend on their success in managing newly skill talent pools (Lorenz, Küpper, Rüssmann, Heidemann, & Bause, 2016). In the traditional way, employees are hired for well-defined jobs by organizations. Ultimately, the nature of the tasks wouldn't change to a great degree, if employees shift a new role in the same organization. That is beginning to change as Industry 4.0 and digitalization is transforming jobs by changing the nature of the traditional tasks.

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Indeed, there has been the growth of contingent work which means various forms of employment related to the completion of a specific task in a relatively short amount of time. Contingent work covers employees in a variety of employment relationships including independent contractors who are self-employed (Barley & Kunda, Gurus, Hired Guns and Warm Bodies: Initerant Experts In a Knowledge Economy, 2006).

The newest additions to this group of contingent employees are the ones who work in the so called "gig economy". Employees in the gig economy participate in spot labour markets, except that "gig employees" typically find their jobs through online platforms and may never meet their employer. Gig employees can be highly skilled or somewhat low skilled. Due to the increase in the number of contingent employees, project-based forms of organizing are becoming ubiquitous across organizations. Started mostly in construction, consulting, aerospace and defence sectors, project work is turning out to be a substantial form of organizing in high-tech industries as well as other economic sectors (Barley, Bechky, & Milliken, The Changing Nature of Work: Careers, Identities, and Work Lives In the 21th Century, 2017). As a result, work in different functions is transforming to more project-based roles and activities. Digitalization enables those project-based jobs to have much shorter deadlines as well.

Furthermore, due to the use of digital technologies, information can be transferred with ease and worldwide. Organizations can develop knowledge in-house, as well as acquire it through highly skilled freelancers that offer their knowledge capabilities through online platforms. Those platforms encourage freelance work and collaborate employees and organizations. Although the collaboration with contingent employees may be completely online, their outcome and performances need to be integrated within the organization (Lanzolla, Lorenz, Miron-Spektor, Schilling, & Solinas, 2018). As a matter of fact, organizations have started to become agile in the new landscape as the content of the existing tasks and skill requirements change.

Indeed, with the changing skill requirements in Industry 4.0 age, recruitment processes have evolved, as well. Finding the right talent has become a challenge for organizations. Replacing long and complicated recruitment processes by freelance talent, has become a way to overcome this challenge. Tasks in organizations are customized and modularized to compete in the digital age (Kane G. C., Palmer, Phillips, Kiron, & Buckley, 2016). Moreover, online platforms are increasingly connecting employees to different career opportunities. While a growing number of work force use these platforms, their potential is increasing rapidly. Using job rating systems to get information on tasks and performance, online working platforms provides an effective way to measure abilities. These dynamics have consequences for the employees, organizations and the economy. Especially, online platforms play an important role in the digital economy. According to a McKinsey research, online platforms are not only cause people to enter the workforce again in flexible employment processes but also advance the matching of jobs and employees within and across organizations (Bughin, Lund, & Remes, Rethinking Work In The Digital Age, 2016). Therefore, nature of the tasks that employees perform, work force and skill requirements have radically changed across digital transformation process. The impact of these changes on organizations will cause them to establish new ways of working to implement Industry 4.0.

CASE STUDIES

Key challenges and the opportunities for Industry 4.0 deployments will now be introduced by giving examples from various case studies. The organizations in case studies are succeeding in their digital

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transformation efforts toward Industry 4.0. They are from various industries. On the one hand, they use technology, on the other hand they develop digital capabilities in their digital transformation processes in order to implement Industry 4.0. These organizations invest in digital opportunities which is a key to success in Industry 4.0. The case studies include information from the websites of organizations as well as the business white paper requested from the organization.

Bosch and Industry 4.0

The digital transformation is affecting markets and competitors alike. It is changing our lives. Industry 4.0 and the accompanying digital transformation of processes allow organizations to act at even greater speeds and, above all, with even greater customer orientation: Prototypes are easy to test, customer feedback is available promptly, and manufacturability findings are acquired without effort. This shortens product life cycles, while raising demand for customized products. Consequently, individual manufacturing processes become more adaptable.

To meet these requirements, organizations developed flexible and adaptable manufacturing processes, by data exchange between machines and their environment. Thus, the physical world of production comes closer to the virtual world of information technology. By this way, organizations become more flexible in the digital world.

Bosch regards this digital transformation as an opportunity to shape the future. The Bosch Group's strategic objective is to create solutions for a connected life.

The connectivity of physical things and new services allows organizations to create new business models that are key drivers for the digital transformation of businesses. More than simply connecting things, with the Internet of Things and digital transformation, there are intelligent automated systems reaching into every corner of the world.

The Internet of Things is not new, but it radically changes businesses and disrupt industries. It is very clear that the IoT is not just about technology, it is much more than that. It is the catalyst for digital transformation that creates business models.

Overall, Internet of Things is both the driver behind and target of Bosch's business activities. Bosch has a unique perspective. At Bosch, the focus is always to make sure the technologies they build are human and humane in nature. In Industry 4.0, people are the key players. Enabled through technology, work is getting more efficient, but machines will continue to play the subordinate role. Employees' work is facilitated to a greater degree than by software-based systems (Innovations, 2018).

Therefore, Bosch is not only a leading user of Industry 4.0 but also a leading provider. In consistent with this strategy, Bosch has its own Industry 4.0 solutions.

In order to support these solutions, Bosch is focusing on its activities on Bosch Connected Industry. With Industry 4.0, manufacturing organizations require increased efficiency through transparency and traceability. Intelligent Industry 4.0 software solutions and services provide consistent transparency and efficiency in processes. Bosch Connected Industry combine these solutions in an extensive portfolio. The objective of these solutions is to make employees work, production and logistics easier. Industry 4.0 software solutions and services are supplied to their own Bosch plants around the world and to their customers.

The software solutions are tested inside their plants. With many plants and warehouses all over the world, Bosch has many years of manufacturing expertise. This experience is integrated into their advanced product development as well as practical solution development (www.bosch.com, 2018).

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Daimler and Industry 4.0

Daimler AG sees Industry 4.0 as the digital transformation of the entire value chain. Physical and digital processes are connected to an increasing extent. Daimler is also connecting the entire automotive value chain including design, production and sales and service. While Industry 4.0 is evolving, the ultimate goal of Daimler is the "Smart Production".

Daimler sees that digital transformation will provide a route to advanced changes in the industry. These changes will influence processes of developing, planning and producing their vehicles.

In Daimler, smart network of human, machine and industrial processes is seen as the future of production. The view of Daimler for the smart production is aligned with a great degree of flexibility. Respond time in production to market changes and customer demands is quicker due to the smart production. Other characterizations of smart production are being efficient and fast. Fully flexible production of vehicles is optimized and quality of control of processes are improved. In Full-Flex plant, several vehicle models can be flexibly produced on the same production band. The plant is continually digitized according to Industry 4.0 and the production networks around the globe are connected to the plant as well. Material flow and quality control processes are digitally interconnected. Besides, green production is given great importance. Employees are supported by different devices in processes. The workplaces are designed as being ergonomically optimized. By this way, employees work at ergonomically optimized workstations. Human-machine cooperation enables to relieve employees by making partial automation feasible. Overall, an employee-centric workplace is created, paying attention to employees' individual requirements.

Work organization, logistics and quality control processes are supported digitally. Digital transformation centers in different areas. One of them is 360-degree-networking from the supplier to the customer. Another one is the digital value chain from development and design to production and customers. For research and development as well as production, 360-degree networking is used so that communication across all units is quick and transparent. Thus, by 360-degree networking, smart production can integrate the real world into a digital one. Processes and systems are mapped in real time along with the factory. Transforming to a fully networked production is the priority of Mercedes-Benz. For instance, production processes are visualized and optimized by digital tools such as "Virtual Reality".

Furthermore, to advance the digital transformation, Daimler has successfully implemented a digital organizational strategy. With this strategy, Daimler aims to shape the digital transformation. Moreover, it gives its employees the chance to shape the digital transformation by involving them in the digital transformation process.

At the cultural level, Daimler adapts its culture to the challenges that digital transformation brings. Connected collaboration is promoted between employees. With digital transformation efforts, Daimler proceeds with the digital change by letting employees experience technologies and supporting employee collaboration. Daimler wants to be the leader of their industry in terms of digital transformation. Accordingly, they support their employees in every aspect to "think digitally". Employees are prepared for the latest technologies. In order to do that, training with a digital transformation focus is given to employees. Digital transformation is seen as an opportunity. Therefore, online learning platforms and working with robots, 3D printing and Augmented Reality are part of the training programs. With digital transformation and automation, trainings provide meaningful learning experiences for employees. Moreover, a culture of diversity in the workplace is built by the help of these trainings in Daimler.

The objective of Daimler is to harmonize their internal mindset with external structure in order to react to the dynamic business environment properly. To support this approach, Daimler focuses on an

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organizational structure that enables fast and agile operation. With the help of Industry 4.0, the organization wants to successfully transform from a leading automaker to a leading provider of mobility. Their success is aligned with their consistent continuation of strategy (www.daimler.com, 2018).

BASF and Industry 4.0

Digital transformation presents great opportunities for BASF. By adopting digital technologies and data, BASF improve the efficiency and effectiveness of its processes. One of BASF's core strengths is "Verbund" integration. The focus of Verbund is the physical integration of production, market platforms and technologies along with BASF's resources and expertise. The organization functions in most of the countries around the world with its six Verbund sites and more than 300 available production sites. BASF benefits from physical, technological, market-related and digital Verbund advantages.

Moreover, digital transformation helps BASF to use its existing resources efficiently, with "Power Plant 4.0". It is an initiative to improve efficiency in organization's activities. Thus, the initiative is a driver of digital transformation in BASF.

An example of digital solutions, which contribute to the efforts of improving solutions and products of BASF, is smart manufacturing. The "Augmented Reality" application supports employees at plants in their daily tasks. Via specially equipped mobile devices, like tablets and smartphones, necessary information is easily accessed through the application. By this way, employees are supported in their workplaces. BASF experiences important benefits of Augmented Reality in the area of simulation, communication and digital learning use cases associated with manufacturing and industrial processes. A primary goal of BASF is to make augmented reality available for use in its plants worldwide. Predictive maintenance is another application which aims to optimize the coordination of maintenance and production processes. It predicts the optimal time for maintenance measures. Available live data is modelled and evaluated by a software. Then, the data is used for maintenance work and forecasting in production processes.

Another area driven by digital transformation is research and development in BASF. High-performance computers are used for simulation and modelling. BASF researchers have the chance to advance totally new approaches by the help of the computer, named Quriosity. It is BASF's super computer and offers approximately 10 times the overall computing power than before. With Quriosity, variations of more parameters along with sophisticated models can be done. It can perform immense number of calculations. With a high degree of computing power and input data, chemical processes are simulated. This increases BASF's efficiency and paves the way for new discoveries. Moreover, Quriosity is connected to Verbund, which has a significant role in production. Quriosity is a useful tool which supports various processes including research and development, production, logistics and new digital business models.

In addition, digital transformation gives researchers at BASF, a great number of opportunities to implement their unique and creative ideas. Digital technologies are integrated into the workflow of research and development departments. Direct access to knowledge-based systems allows analytical approaches to be used for problem solving. Thus, digital transformation offers a lot of potential in research and researchers in BASF benefit from it. For instance, working with the data on catalysts enables the researchers to have detailed information regarding the prediction of catalysts' performance and lifetime. Another example is related with crop protection. BASF uses digital transformation to provide solutions for crop protection. It is significant to optimize agricultural production in order to improve the quality of life and meet the needs of future generations.

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BASF is also using digital transformation in its logistics. Autonomous and automatically driven vehicles are used in their plants. As means of digital logistics, these vehicles enable to save significant amount of time in delivery. Besides, augmented reality applications support information flow in the plants. Information is shared via specific tablets on site. Employees are supported by digital technology trainings. BASF also use smart energy network. The aim is to boost efficiency with this special software. Information on production and sales is analysed via the software and used to forecast energy requirements.

At BASF, employees are the key to digital transformation. The digital transformation approach is one of the drivers of organization's success in Industry 4.0 (www.basf.com, 2018).

FUTURE RESEARCH DIRECTIONS

Industry 4.0 has a very high potential to impact the organizations in different ways by providing opportunities for improving business processes and operational effectiveness. If organizations want to be aware of the advantages in these areas, the need to build the necessary digital capabilities. This is a challenging task that requires many changes throughout the organization. Not only the processes, but also the strategy and the capabilities will need to change. Organizations should act in a timely manner in order to adapt to the digital environment (McKinsey&Company, 2015). In order to succeed in Industry 4.0, organizations should start their digital transformation efforts immediately. The success of organizations in Industry 4.0 depends on digital transformation, so organizations should invest in their digital capabilities. Adapting the components of digital congruence has a significant importance for the digital future of organizations.

CONCLUSION

In this chapter, digital transformation efforts of organizations in order to benefit from Industry 4.0 are reviewed. Industry 4.0 and the accompanying digital transformation are dramatically changing the world we live in. Industry 4.0 and digital transformation create a world by connecting people, organizations and systems. An interconnected environment is created in which opportunities and challenges exist. In order to benefit from the opportunities of Industry 4.0, organizations need to adapt to digital environment. Digital changes occur at a great speed in this environment. The expectations for Industry 4.0 require organizations to embrace these digital changes which relate to all areas of their organizations. Digital and physical processes are becoming increasingly connected and capabilities of organizations play an important role in this process.

The main objective of this chapter is to provide an understanding of digital congruence in Industry 4.0. Digital capabilities of organizations are named as "digital congruence". The term, digital congruence refers to culture, people, structure and tasks of an organization. Digital congruence is a new term. The focus of digital congruence is that every component of it, should be aligned with each other as well as organizational strategy. The purpose of this chapter is to analyse how each organizational component relate to digital transformation along with Industry 4.0. A new perspective to digital transformation and Industry 4.0 for organizations is reflected in this chapter. As digital transformation leads to fundamental changes in the world, it effects different processes and structures in organizations. To remain successful

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and competitive in the digital world, it is important for organizations to understand the impact of Industry 4.0 on the components of digital congruence. A perspective of Industry 4.0 and digital congruence as a strong predictor of success for organizations is reflected in this chapter.

Moreover, this chapter discusses the components which are tasks, people, structure and culture, in depth. The chapter aims to build a deep understanding of how organizations adapt the components in order to transform digitally. While Industry 4.0 is seen as an evidence of a fundamental shift, it represents the ways of how digital technologies would be embedded within organizations. Digital technologies help the organizations to transform the way they work including tasks, employees, structure and culture. The ability to orchestrate the components is the key to a successful digital transformation. Digital technologies are shaping and reorganizing the organizations. New ways of working and changing skills of the employees are supported by digital technologies.

While the way how organizations work changes, tasks are customized accordingly. They are mostly grouped and divided between teams. New ways of working include project-based roles and freelance work. Organizations become more agile, while content of the existing tasks change.

With the changing employee roles, employees need different skill sets in the digital era. Thus, to provide appropriate training programs for employees become significant. By these trainings, employees have the chance to operate and manage Industry 4.0 solutions. Furthermore, new ways of finding new talent is a challenge for organizations. Organizations require employees with relevant skill sets to leverage digital transformation. The lack of such talent can be countered by continuous in-house training to acquire the required digital skills.

Organizational culture is an important success factor for organizations as well. While defining a digital strategy is critical, promoting a culture that supports the strategy is equally important. Thus, culture should be in line with organizational strategy. In addition, lack of digital culture is a major problem to digital success. Transforming the organizations digitally is most likely related to developing and sustaining digital culture.

While digital transformation is connecting the world, the technological developments are creating new types of businesses. These have an influence on the structure of organizations. The transformation causes a radical change in organizations in terms of speed and flexibility. Agile ways of working in organizations gain importance with new functional units and new forms of collaboration. Integration between teams makes them work on solutions across the organization. That means, rather than formal organizational hierarchies, the teams in organizations focus on collaboration. The changed organizational structure involves enhanced collaboration as a result of less hierarchy.

Overall, this chapter presents how digital transformation and implementing Industry 4.0 will impact the digital capabilities of organizations. Responding to change in Industry 4.0 requires keeping track of the latest technological developments. It has become an absolute necessity for organizations in their journey of digital transformation. As the way organizations are structured changes, organizations adopt completely new ways of doing work. Not only organizational structure but also organizational culture, tasks and employees are parts of the change. The organizations which successfully navigate the change, will have many opportunities to succeed in Industry 4.0. Speed, unpredictability, collaboration, change characterize the new environment of digital transformation. The broader implications and positive impacts of digital transformation are significant for organizations. Alignment around structure, tasks, employees and culture will ensure digital transformation adoption to succeed in Industry 4.0.

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KEY TERMS AND DEFINITIONS

Agile Methodology: A type of methodology that involves multidisciplinary teams, continuous level of collaboration, short set periods to complete specific work in organizations.

Congruence Model: A framework in order to analyze how well the key components of an organization interact.

Digital Congruence: A new concept which is the culture, people, structure, and tasks of an organization aligned with each other and organization strategy and challenges of digital environment.

Digital Culture: A type of culture that separates an organization from others and executes digital transformation.

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Digital Talent: The talented employees who are able to adapt and use the existing digital technologies.

Digital Transformation: Transformation related to how organizations adapt to digital trends as well as adapting to how customers, employees, and competitors use digital technologies.

Industry 4.0: The technological evolution that connects embedded production technologies and smart production processes.

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Chapter 3
Opportunities, Challenges, and Solutions for Industry 4.0

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ABSTRACT

Industry 4.0 (I4.0) is the fourth industrial revolution sweeping through the world of manufacturing. This revolution integrates the current trend of intelligent automation with internet of things (IoT), big data, and artificial intelligence to bring about extraordinary technological innovation, economic growth, and tremendous progress to organizations of all shapes and sizes, on a magnitude beyond the current imagination. The disruptive technologies introduced by I4.0 represent a leap forward from more traditional automation to next generation industrial production based on fully web-based cyber-physical systems (CPS)s. To full understand the I4.0 concept and implementation, this chapter makes an in-depth analysis on the issues and controversies of I4.0, recent technological advancement, management and organizational concerns in terms of opportunities and threats, capital investment and skillsets, cybersecurity threat, ethics consideration, current challenges facing organizations and industry in terms of geopolitical domination, economic and social disenfranchisement, job destruction and job creation, the roles of multinational corporations, lack of technologies capabilities, lack of skillset, and skill mismatches. This chapter also makes suggestions for solutions and recommendations in terms of the role of government and incentives and grants; assessment tools; collaboration; the development of local companies and small and medium-sized enterprises (SMEs); upskilling, reskilling, and lifelong learning; education; universities and students; skilled graduates; and future research and directions.

INTRODUCTION

Industry 4.0 (I4.0) is the common term referring to the use of cyber-physical systems (CPS) which comprise numerous major innovations in digital technology such as artificial intelligence (AI), Internet of Things (IoT), machine-to-machine link, data capture and data analytics, cloud computing, advanced robotics and smart production facilities. Such systems are capable of independently exchanging informa-

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tion, triggering actions, controlling each other independently and making autonomous decisions. In fact, CPSs are driven by cutting-edge software, computational power, programmable logic controllers, and sophisticated sensors and cameras to process vast amount of data using advanced predictive algorithms, monitor real-time transactions at every monitor real-time transactions at every stage of a process in the value chain right from customer ordering, marketing, suppliers, procurement, design and development (R&D), manufacturing, logistics and customer services, finally make large-scale centralised decisions without human intervention (Brettel, Friederichsen, Keller, & Rosenberg, 2014). In another example, such systems can use Internet Protocol (IP) addresses, Quick Response (QR) codes and Radio Frequency Identification (RFID) tracking tags to keep track of the manufacturing of every product and process using by online computer and smart-phones apps with the ease of a button and on-the-go.

The development of I4.0 technologies is fast changing the landscape of global supply chain at a breakneck pace. In this regard, digitalisation of the supply chain is underway to achieve operational efficiency and cost competitiveness. MNCs can leverage on digital global economy which are driven by information, ideas and innovation. Most leading companies are deploying such I4.0 technologies to share market intelligence and organizing their orders by divisionalsing their product lines according to the cost-base structures, economies of scales and tariff-free, and full market access with a view to realising high-flexible, individualised and resource-friendly mass production. In other word, I4.0 technologies will make such smart factories work easier, safer, leaner and more productive through I4.0 digital sphere. In today's competitive environment, most MNCs certainly cannot afford to look nervously over their shoulders at rivals taking command of the technology revolution, instead quickly jump on the bandwagon of adopting I4.0 cutting-edge technologies to stay competitive, connect more closely with customers and finally propel organisations towards for more sustainable growth (Ghobakhloo, 2018; Pandiyan, 2017).

Taking a quick look back in time the at these first three industrial revolutions, it is worth mentioning that Industry 1.0 refers to use of the mechanical production harnessing the power of water mills and coal-fired steam turbines in Britain in the late 1765, Industry 2.0 refers to the introduction of division of labour and electrically powered assembly lines especially pioneered by Henry Ford and Frederick Taylor in the manufacture of cars in 1870, and finally Industry 3.0 refers to the use of electronics and telecommunications and computers that further automate production in 1969. Over the course of history, mankind has perfected its industry by creating and striking innovations all throughout their revolutions. Indeed, previous three industrial revolutions have liberated humankind from animal power, made mass production possible and brought digital capabilities to billions of people (Sentryo, 2017).

COUNTRIES AND INDUSTRIES BACKGROUND

The concept of I4.0, also known as Industrie 4.0, was originally coined by the Germany government in 2012 to drive its High-Tech Strategy under the 2020 initiatives. As I4.0 holds promises of scientific and technology development, industrial optimalisation and upgrading, and finally major productivity improvement, major developing and developed countries have scrambled to join the bandwagon with different variants to play catch-ups with I4.0 but maintain their competitive edge beyond traditional industrialisation pathways for wealth creation and prosperity. For examples, Made in China 2025 (by China); Smart Manufacturing (by USA); Revitalisation Robotics Strategy (by Japan), Manufacturing Innovation 3.0 (by South Korea), Smart Nation Programme (by Singapore), Future of Manufacturing 2050 (by UK), and Productivity 4.0 (by Taiwan) are some of the variants. At the organisational level,

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world leading companies are at the forefront of the I4.0 blueprints. For example, Google's Waymo self-driving cars, IBM's Watson AI Systems, Google's AlphaGo, Siemens's Mindsphere, Bosch's Software Innovation, Amazon's Go autonomous stores and Chinese e-commerce giant Alibaba's Ant Financial. Other tech giants include Facebook Apple, Tencent and Baidu and IFLYTEK (voice recognition tech firm). These companies are redefining high-tech innovation and product in the most trailblazing ways (Matthew, 2018). Their groundbreaking technologies and innovation in automation, computerisation, AI logarithms, 3D modelling and 3D printing have reshaped and transformed the business world in the most unpredictable ways.

For design and development, new technologies significantly reduce the risk of creating innovative designs and producing smart products without the burden of a heavy capital investment in machines and materials because it is possible to build prototypes in computer software before undertaking mass production. Indeed, the idea of smart factory is becoming increasingly ubiquitous as more industries are adopting such technologies which allows it to work longer, 24/7 and with near zero defects that humans are incapable of. However, most countries are aware of the high-tech conundrum, namely, on one hand, they must embrace Industry 4.0 to avoid being left behind, but on the other, they may push back I4.0 in order to keep their cheap labour and low-skilled workers fully employed to maintain economic and social stability.

OBJECTIVES OF THIS CHAPTER

The main objectives of this chapter are to examine the I4.0 concepts, issues, practices and ramifications. It covers opportunities, challenges and solutions of I4.0. Indeed, I4.0 offers great opportunities for organisations to achieve a very significant gain in productivity and technical capability where everything will be automated. However, I4.0 poses challenges to industries leaders and practitioners as the advancements have degenerated into myriad of issues like inequality, skill shortages, cybercrime and technological unemployment. Therefore, practical and bold solutions must be established to ensure smooth adoption of I4.0. In this regard, multi-stakeholders especially policymakers, industry players, universities and academia and MNCs can equally play a crucial role in facilitating, working out blueprints and innovative solutions and fine-tuning the execution plan and thereafter embarking their journey towards I4.0.

ISSUES AND CONTROVERSIES OF INDUSTRY 4.0

There are a lot of economics opportunities surrounding I4.0. According to Boston Consulting Group (2015), the widespread adoption of I4.0 could boost labour productivity by as much as 30% by 2024, stressing the economic and technological benefits of I4.0 technologies far outweigh costs of investments and maintenance. Brynjolfsson and McAfee (2014) argued that in the era of the 'Second Machine Age', a digital economy yields unanticipated paths for making record profits and boosting productivity. As humanoid robots on different platforms can learn, communicate control and "share knowledge" with each other without human intervention, significant improvements in quality and reduction in cost and time can be made (PwC, 2016). There are many advancements made for I4.0 technologies. According to BCG (2019), there are nine disruptive technologies that forms the building block of Industry 4.0 that have spurred tremendous progress in developing the next generation of smart manufacturing technolo-

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gies and reinvention. They are big data analytics, autonomous robots, simulation, horizontal and vertical system integration, the industrial internet of things, cybersecurity (plant security, network security, system integrity and risk), the cloud, additive manufacturing (3D printing) and augment reality. Of which, AI, an idea of decoding the human brain and mimicking human-like functions which was created by John McCarthy in 1956, has exploded in 2010 thanks to very fast state-of-the-art computer processors that allow the analysis of huge amount of data, learn from experience, adjust to new inputs and perform human-like tasks. AI has become the most important driving force for leading a new round of scientific and technological revolution and industrial transformation with leaps and bounds. For instance, AI, together its subset machine learning and deep learning, is at the forefront of the tech boom in the fields of virtual assistants, translations, vision for driverless delivery trucks, drones and autonomous cars, chatbots and service bots, image colorisation, facial recognition, medicine and pharmaceuticals, and personalized shopping and entertainment around the globe (Lee, 2018; Marr, 2018).

In addition, Schmidt, Möhring, Härting, Reichstein, Neumaier and Jozinović (2015) stressed that the most important technologies are mobile computing, cloud-computing, and Big Data because these technologies can provide services that can be accessed nearly real-time, globally via the Internet and at the same time, support services can be easily developed, integrated and deployed. In this context, organisations can explore rich data visualisation and advanced reporting for smart decision making. Smart intelligence systems will create a superior capability that has never before been possible to catapult the industry into next industrial revolution with new means of efficiency, accuracy and reliability. Kuhn (2108) stressed that world powers have relentlessly sought breakthroughs in big data intelligence, deep machine learning, brain-like computing, multimedia computing, human-machine hybrid intelligence, swarm intelligence, expert systems, even quantum intelligent computing for a race toward the global tech supremacy. Such cutting-edge, novel and unique "futuristic tech" should empower people especially workers rather than replace them, and also serve the society rather than disrupt it. Experts believe that robot is not something to fear but to embrace as it will take a long time before AI can literally take over the world, causing uncertain, even dire, consequences for humanity.

I4.0 also provides huge opportunities for creating innovation, restructuring industrial systems and uplifting the wellbeing of society, organisations and skilled workers. Harvard Business School (2018) reported that that since its inception, I4.0 remains an epicentre for innovation and economic growth and transforming people's lifestyles with an array of applications in in the field of manufacturing, but also urban management, public services, transportation, logistics, health and security. Rapid deployment of smart manufacturing technologies in robotics, AI, IoT, data analytics, quantum computing and virtual reality has spurred tremendous progress in industrial innovation. This has generated ample opportunities to companies of all sizes to leverage on I4.0 technologies to achieve quantum leap in performance across industries. The growth of smart factories, advancements in supply chain management, and transformations of traditional manufacturing relationships are another strong testament that I4.0 technologies have far-reaching, profound implications in the digital age. It is envisioned that I4.0 technologies will far exceed the three previous three revolutions in terms of smart adaptability, autonomy, efficiency, functionality, reliability, safety, and usability because the programmability, memory storage capacity and sensor-based capabilities are far more advanced and enhanced. Indeed, many scholars believe that I4.0 is an industry game-changer that seems to spring right out of science fiction movies with 'Terminator', 'Norman', 'Sophia' robots with a humanistic face, mobile internet, and mobile supercomputing.

However, there are many naysayers who predict various doom, rather than gloom scenarios for countries, societies, organisations and workers. According to Deloitte Insights (2018), while digital trans-

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formation is taking shape in nearly every organisation, I4.0 paradoxes can be observed around strategy, supply chain transformation, talent readiness, and drivers for investment because most organisations need to overcome the disconnects between companies' plans and actions, and tradeoffs between their current operations with the opportunities for innovation and business model transformation. In addition, there is another negative phenomenon, coined as 'productivity paradox' which basically suggests that dramatic advances in computer power and increasing investment in IT does not necessarily cause an increase in productivity in national economy (Brynjolfsson, 1993). Researchers even suspect that this highly-debated I4.0 concept may be a hot air and hype as they found out that only four of ten companies made good progress—with the strongest results in Germany and among technology suppliers (Breunig, Kelly, Mathis & Wee, 2016, Ghobakhloo, 2018). Critics also believe that I4.0 may bring major disadvantages to workers. There are countless dystopian viewpoints painting a foreboding scenario of the future of work, where millions of jobs will disappear in the coming decade due to increasing automation and AI. It is a fact that when new automation with AI capability is introduced, there is a concern for loss of high-paying jobs in the market (Mashelkar, 2018). Experts warn that society is confronted with 'win-lose competition' where high-skilled workers are rewarded with high pay and the rest of workers are left out in the cold. Another imbalance is the ownership and wealth concentration which are in the hand of chosen few. These development gives rise to a number of issues like unemployment, inequality, market consumption and tax revenues.

With regard to the cost of capital investments, I4.0 requires substantial upgrading of high-tech hardware and software to support large-scale CPS systems in automated process control applications. The installation of both hardware - intelligent equipment, advanced camera and smart sensors, and software - coding, programming and operating control systems, necessitates commitment of huge capital investment. Studies of manufacturing show that sophisticated, flexible, expensive equipment often needs sophisticated, flexible, expensive people to operate and maintain it. This means highly-trained engineers, data scientists, software engineer, cloud computing programmers, object craftsmen, and robot operators with good knowledge and skills in data analytics capabilities are required to tackle any emerging technical issues and make final data-driven decision in a large scale, complex problems.

There is an issue of cybercrimes in the era of I4.0. Most industry players are concerned with threat to data security and privacy besides system reliability and stability, and technical production outages. It is because existing IT infrastructure is incapable of managing information security, and inter-company data management, thus undermining digital trust in a 21st century digital environment (PwC, 2016; Schröder, 2017). In addition, recent advances in hacking technologies have made organisations more nervously and vulnerable to cyberattacks. Under this situation, risk-adverse organisations are reluctant to adopt the cloud-empowered I4.0 technologies and allow inter-companies link out of fear of losing control over data privacy and trade secrets. For example, the 1.5 million SingHealth patients' non-medical personal data are stolen by well-planned hackers. To prevent future attacks and security issue, this organisation decided to pull the plug and go offline from the public domain and operate manually their operations.

With regard to ethics in I4.0 technology, the development of future technologies and AI also creates serious concern to civil rights. A case in point is the recent backlash of a tech giant's Face Recognition technology which has caused controversies due to its questionable accuracy of the software and perceived violation of civil rights. There is also a high chance of potential misuses and abuses of I4.0 technologies by rogue states, criminals and lone-wolf attackers. Researchers warn that rapid advances in AI are raising gargantuan risk that malicious users will soon exploit the technology to mount automated hacking attack, causing driverless car crashes or turn commercial drones into targeted weapons. Scientists, busi-

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ness leaders and ethicists are concerned with the ethics of tech giants participating in the development of military of autonomous war machines and killer robots. This not only poses imminent threat to the safety and security of a country but also have disastrous consequences on mankind (Horowitz, 2016).

In fact, Bossmann (2016) asserted that there are top nine ethical issues when developing AI technologies. They are a) Unemployment - what happens after the end of jobs? b) Inequality - how do we distribute the wealth created by machines? c) Humanity - how do machines affect our behaviour and interaction? d) Artificial stupidity - how can we guard against mistakes? e) Racist robots - how do we eliminate AI bias? f) Security - how do we keep AI safe from adversaries? g) Evil genies - how do we protect against unintended consequences? h) Singularity - how do we stay in control of a complex intelligent system? and j) Robot rights - how do we define the humane treatment of AI? In this case, I4.0 technology inventors and innovators should have strong moral standard to guide their research and development to ensure to ensure they respect ethical boundaries rather than cross them for profitability. To uphold ethical values, they should have the willingness to foster public R&D, conduct open discourses on the purpose of technologies, deployment and ensure full adherence to code of ethics for technology to minimise harm to the public. In this regard, Smith (2018) suggested that five core principles to keep AI ethical and avoid controversy and conflict. They are namely a) AI must be a force for good and diversity, b) Intelligibility and fairness, c) Data protection, d) Flourishing alongside AI, and e) Confronting the power to destroy. In brief, I4.0 technology key decision makers should have strong moral compass to fulfill a social purpose and eventually serve the long term benefits of mankind. It is absolute crucial to inject human culture and values into machines and ensure human should remain "in" or "on" the decision making loop so that AI will act without accidentally harming human, especially preventing an artificial stupidity like allowing AI to conclude that the best solution was to eradicate human beings.

CURRENT CHALLENGES FACING ORGANISATION AND INDUSTRY

As I4.0 is coming at a much faster pace due to the advancement and diffusion of AI technology, it is a challenge for all key stakeholder to anticipate the way corporations organise their operations and plan their goals and protect, the way workers protect their jobs and rights, and finally the way human interact with machine harmoniously for better efficiency and productivity. What is certain is that I4.0 has become the juggernaut and behemoth that define the future world of manufacturing and services with their far-reaching influence on future business, societies, jobs and world politics. To overcome the massive impact of the I4.0 technologies, it is important for all key stakeholder especially the world leaders, industry leaders, policymakers and academics to work together to thrash out the issues, mitigate challenges and work out innovative solutions to make I4.0 works for the benefits of all (Oesterreich & Teuteberg, 2016; Star Online, 2018).

GLOBALISATION 4.0

In the context of current world trades, there is a new trend of globalization pushback, dubbed de-globbalisation which poses serious challenges to global world order and economic growth. Schwab (2018) argued that the world, which is highly-interconnected, is surprisingly vastly under-prepared for a new type of globalization, coined as 'Globalisation 4.0' which calls for a more inclusive and sustainable

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global architecture and governance in terms of balancing paradoxically the climate change and economic growth, patriotism and accepting immigration, future of work for man or machine, future technology for life better or worse, a fairer economy for rich and poor, and working together or competing in knowledge, information, and technology. These challenges and contradictions are being addressed and redefined by the deep political, technological, society and economics forces. It is optimistic and hopeful that under the new era of Globalisation 4.0, the current world trade issue is not a zero-sum game, but a sweet spot for building harmonious bridges of trust and technical collaboration between the world powers for the future mankind.

ECONOMIC AND SOCIAL DISENFRANCHISEMENT

Disruptive technologies impact almost every facet of economic activities from products and services to business models. According to PwC (2016), close to half of industrial companies in Asia-Pacific rate their level of digitalisation as "high" which lead to the annual digital revenue increases of 2.9% on average and cost reductions of 3.6% per annum. In another report, the 4.0 Research (2018) also forecasted that from 2016 to 2023, Asia-Pacific Industry 4.0 market is the world's fastest, growing at a CAGR of 23.7%. That being said, Brynjolfsson and McAfee (2014) argued rapid automations could bring immense economic disenfranchisement. Recent indicators reflect that there are fewer people are working, and wages are falling. In the market economies, reduction of high-paying jobs will lead to reduction of worker incomes. Such declining incomes will significantly reduce consumption, thus disturbing the supply and demand of consumer economy, widening income gap (Ford, 2015). This situation is likely to cause social instability if no action is taken address the issues of mutation of traditional industries and jobs, arising from adopting I4.0.

Disruptive technologies are reshaping the future of the global workforce, giving rise to the so-called gig economy. In a gig economy, temporary, flexible jobs are commonplace. 'Shamrock' organisations with a core of essential executives and key workers tend to hire independent contractors and freelancers in order to reduce the overhead cost. This new wave of economy undermines traditional economy of supply and demand, ownership and traditional workers who prefer full-time job for lifetime career advancement. For examples, Uber, Grab and Airbnb are often described as products of the "sharing economy". It produces wealth for the benefits a tiny handful of the superrich rather than the workers. It is therefore necessary and make sense to counter the rise of 'uberisation' of economy and business in the long term.

JOB DESTRUCTION AND JOB CREATION

In the changing era of job landscape, there will be a transition of jobs gained, job changed, and jobs lost in time of automation but these disruptions on the horizon may vary country by country, with the largest disruptions expected in advanced economies (Alsen et al., 2017). It is inevitable that traditional technologies and jobs are being replaced by high-value industries like intelligent driving, big data and data services. Such replacement and compensatory effects are in line with the Schumpeter's theory of creative destruction where existing, traditional businesses and jobs are destroyed and replaced by new industries and new high-skilled jobs through new technologies and collaborative-networked innovation. Most experts predict that I4.0 technologies especially AI, deep learning and IoT will have a devastating

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impact on traditional industries and workers as it will obliterate half of all types of jobs. In an automated future, many jobs that will disappear in the next 20 years is due to automation and AI. According to Frey and Osborne (2013) from Oxford University, 47% of US jobs can be automated within the next two decades. It is predicted there will be significantly drop in demand for professions of all kinds, ranging from commodity salespeople, report writers, journalists, news authors and announcers, accountants and bookkeepers, lawyers, doctors, call-centre workers and telemarketers and car/bus/truck drivers (Brynjolfsson & McAfee, 2014). It is because it is possible to automate repetitive mundane and potentially 3D (dangerous, dirty and difficult) jobs with artificially-intelligent robots of all shapes and sizes in the manufacturing sector. In addition, the development of machine and deep learning, algorithm-driven decision frameworks, multi-language simultaneous translation, and rapidly improving speech-, voice face-recognition, VR panoramic navigation system, Amazon's Alexa and Echo smart speaker, Siri-like intelligent personal assistant programme technologies has accelerated the robotic process automation (RPA) in the service sector (Brynjolfsson & McAfee, 2014; Economist, 2018). If such full-scale adoptions of automation go unchecked, then both blue-collar jobs and white-collar professions alike will evaporate, eradicate their wages and incomes, thus squeezing working- and middle-class families ever further. It is the biggest fear of jobless future, causing tectonic shift in the meaning of work and society as there will be unprecedented inequality between the haves and the have-nots in a two-tier society. In flexible and reconfigurable smart factories, there will be lot of highly-automated machines, operating in a non-sweatshop environment and supported by less skilled workers slaving over machines. Those displaced workers will need to overcome the inertia of traditional operations and quickly need to be reskilled and retooled. They need to be a jack of all trades, becoming multi-skilled and multi-tasked workers. Those who cannot unlearn and relearn new skills, run the risk of being made redundant and retrenched.

However, Burke, Mussomeli, Laaper, Hartigan and Sniderman (2017) asserted that a smart factory does not necessarily translate into a "dark" factory. People are expected to be key to operations as technology is historically is the net job creator. I4.0 needs smart personnel to work in tandem with smart machines which they can significantly improve or co-create through integrating smart intelligent systems. New industries and new job like 3D designers, developers, engineers, programmers and scientists are highly sought after in the I4.0 technologies. New technologies will certainly create new products and new services at lower costs, thus creating new opportunity for job creation. Old technologies and old jobs will be available and not be quickly replaced because new technologies normally encounter teething issues like time and hedging risk delays to their implications, expected slow demand and technical limitations. Under this circumstance, organisations have to address of the issue of "hidden factory" that results from a mix of old and new technologies that impedes the smooth running of connected operations. There are also safe jobs that robots cannot do very well like managing people, imagination and creativity, and judgment and decision making.

THE ROLES OF MULTI-NATIONAL CORPORATIONS

The rise of smart automation and globally connected IT systems heralds profound transformations of entire systems of production, management, and governance in established MNCs. It is clear that I4.0 has dawned on MNCs and local big companies as witnessed by the extent of the proliferation of I4.0 technologies in the industries. According to Ruban (2017), more than 5,000 MNCs have already started implementing some of these new technologies in their factories and plants. Although there will be a

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significant reduction in human dependency especially from the low-skilled and medium-skilled workers, I4.0 demands new highly-skilled workers. It is true that flawless manufacturing execution of I4.0 is only possible with the right integration of highly-skilled workers, intelligent machines and technologies. It is important to highlight that most MNCs have strong inclination to employ more machines rather than humans because machines can precisely produce parts with high quality products yet without human errors, thus increasing efficient and accuracy. It is logical to automate and robotise their operations when there is an acute shortage of well-trained workers. Small-scale industrial, lightweight robots or "cobots" are deployed in repetitive processes, which tend to be voluminous and prone to error, along with human employees to help keep assembly lines moving. Human employees have to change their work culture in order to interface and work alongside with cobots. In future, it is not inconceivable that humans have to work with highly intelligent robots that talk to each other, learn on their own through AI.

LACK OF TECHNOLOGICAL CAPABILITIES

Although there are much discourses and talks about the I4.0, many business leaders only had a vague notion of what it is. Local companies lack of I4.0 technologies and are still ill-fitted for a future that demands digital prowess. MITI (2018) identified that major obstacles impending local companies from moving towards and exploiting the full potential of I4.0. They need a lot of catching up to benefit from the IR4.0 because they are lack of awareness on the concept of I4.0; no clear comprehensive policy and coordination on I4.0; infrastructure gaps particularly the digital infrastructure as well as ecosystem gaps; lack of targeted incentives to incentivise more companies to move to I4.0; mismatched skillsets and lack of right human capital; and lack of interoperability and standards resulting in difficulty of integrating different systems and reliability issue.

In the 2016 FMM survey done by Monash University, 40% of small and medium sized enterprises (SMEs) are of the view that they do not need the internet to run their business. According to Ong (2017), SMEs face barriers to adopt I4.0 due to low awareness towards I4.0, lack of budget or funding constraints, lack of technical knowledge and practical skills to go into automation and beyond, and lack of skilled workers and training. In another survey, Ganapathy (2018) found that the main obstacles to SMEs in adopting I4.0 are systemic lack of funding, talent and knowledge concerning implementation. These barriers prevent them from fully adopting I4.0. It is a fact majority of local companies and SMEs remain primarily family-owned business with a simple structures and technologies, and therefore they prefer to serve more domestic market rather than global market (Musa & Chinniah, 2016). It is also widely recognised that resource-constraint SMEs have resisted the temptation to follow footsteps of big corporations. Many SMEs prefer to keep their foreign workers, rather than to invest heavily in new technologies as high-cost robots remain an unpopular choice. Without easy access to financing, SME owner-managers put high priority to routine jobs of meeting daily deliveries with target quality, cost and delivery to survive and continue to prosper, rather than incurring capital investment. SMEs are risk-adverse and more cost cautious when investing in high-tech machine, firm capabilities and hire talents to future-proof their business to stay in the game. To overcome the status quo, a new breed of dynamic local companies and SME owner-managers is required to build up new technologies to face new emerging technologies disrupting the market. It is important to note that some high-tech, high-growth, 'Gazelle' who manufacture sub-assembly high-tech products for MNCs may stand a chance to leapfrog their development and growth into large enterprises and eventually become large corporations (Sims &

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O'Regan, 2006). In fact, local companies have to tackle their technical and operational issue by recruiting high-skilled and highly-trained workforce. In terms of management and leadership, owner-managers need essential skills in transformational leadership, technical expertise, entrepreneurship to innovatively navigate their operations and tenaciously evolve into bigger enterprises (Ng & Kee, 2017).

SOLUTIONS AND RECOMMENDATIONS

After evaluating the issues and challenges related to I4.0 implementation, it is necessary to provide solutions to asset and technology, people skills in order to survive and thrive in the future in today's rapidly-changing global and vibrant digital economy.

THE ROLE OF GOVERNMENT

Policymakers should establish I4.0 masterplan for industries through regulating policies and initiatives to attract strategic investments in I4.0 technologies and anchor the country's competitive position in the global value chains. Such roadmap provides a clear direction for key industry players and streamline fast-track programmes related to I4.0 technologies. It is high time to engage with all stakeholders and create awareness of I4.0 concepts and toolboxes for an automated future. Revisiting the issues of worker rights and livelihoods, there is a need to maintain a delicate balancing of creating new jobs and losing job for workers threatened up by new emerging technologies. The government has to find alternative industries by offering employment. It may be inevitable for regulators, working in tandem with private sectors and trade unions, to enact legislations to deaccelerate the adoption of I4.0 technologies to prevent the peril of technology where there is mass unemployment in society and technology take control of human lives. It is inconceivable to see humans become slaves to technology rather than technology serving humans in a new social contract. With regard to incentives and grants, the Government should provide incentive and grants to deserving MNCs and local companies, besides building strong infrastructures, ecosystems and strong legal framework for I4.0 (MITI, 2018). Alternatively, fintech companies with mobile e-payments should be allowed to legally offer financial assistance to local companies through equity crowdfunding (ECF) peer-to-peer (P2P) lending platforms. This will certainly help defray the huge capital outlays and the cost of hiring highly skilled, well-paid talented professionals and expatriates. This will boost up the bench strength of workforce to maximize the economic returns of I4.0 investment. They should make use of the government financial assistance to upgrade and install new technologies. Upgrading and R&D efforts, virtual manufacturing lab, a digitised lean assembly line and intelligent control room could help organisations design and produce world-class products and services.

In order to ensure only deserving and well-prepared organisations obtain financial assistance, it is necessary to assess the overall preparedness of of organisation to embark on the I4.0 journey. It is important to evaluate the existing levels and standards of skilled workforce, smart machines and advanced technologies in operations. To determine its readiness and suitability in the I4.0 adoption, a diagnostic tool called the 'Smart Industry Readiness Index' run by Singapore Development Board in partnership with TÜV SÜD, could be adopted (EDB, 2017). It consists of 3 fundamental building blocks, namely: Process, Technology and Organisation with 8 pillars of focus and 16 dimensions of assessment. Alternatively, McKinsey and The University of Warwick also offers the Industry 4 readiness assessment

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tools to assess whether companies have the right capabilities and skills and are capable of housing I4.0 technologies and go digital (Daub & Wiesinger, 2015; WMG, 2017). Subsequently, organisations should focus on feasibility and cost-benefit analysis to make business decisions of becoming early adopters of technology and innovation or just laggards in technological progress.

In term of technical collaboration, the government has to strengthen the industry-academia partnership for transfer of I4.0 technology, technical know-how and experiences to address the formidable challenges in the adoption of I4.0 (Switzerland Global Enterprise, 2017). MNCs and local companies can have a world-class platform to connect, exchange deeply, build consensus, promote the development together and test-bed solutions before scaling to the world market. Such ongoing collaboration can drive significant transformation in this digital age and rise to the challenge of I4.0. They have to invest in R&D to encourage technological innovation and to boost manufacturing capacity up the value chain. More joint R&D activities should be carried out to minimise industry segregation and improve networking. As the external task and general environments are volatile, it is imperative that MNCs and local companies they should have long term policies and strategies to guide their execution and to grow with the current challenges.

The government can play a facilitating role between universities and private sectors. With partnership with leading industries, universities have to engage in high-impact R&D in order to be at the forefront pioneering new knowledge and technical knowledge. Universities should develop extensive academic link and industry network to offer industrial attachments opportunities. Established corporations should roll up apprenticeships and traineeships programmes to train unskilled workers to become competent in the competitive labour market. It is essential to equip technically-minded graduates with 21st century multidisciplinary skills and tools to increase their chances of employability.

EDUCATION

I4.0 has given a new impetus to educational transformation of its content and delivery across disciplines through technological innovations. With the upcoming changes in I4.0 taking place, it is necessary to closely re-examine the curriculum and delivery through a mix of online and offline learning. Curriculum should be revamped to include technical aspects of autonomous robotics, computerisation, IoT, machine learning, AI, distributed ledger technologies, data analytics, cybersecurity, data science, and cloud computing. The technical contents should be industry-driven based on the existing tech giants. Revised course outlines in advanced application software such as Microsoft Visual Basic, JAVA, HTML, Javascript, Microsoft Access, MySQL, XAMPP and Notepad should possess industry certification for relevancy and employability. To tackle the challenges faced by students, industry and academics, there should be more digital and information literacy introduced to test, pioneer and learn new ways of solving problems of enormous complexity in configurations and calculations. Educators in the realm of I4.0 need to keep abreast of I4.0 technologies and discuss the frontier trend of smart technology in AI, Big Data, data science and data analytics capabilities. In this context, both science, technology, engineering and mathematics (STEM) and technical and vocational education training (TVET) education systems should be emphasised to ensure sustainable and balanced supply of both academic-based and skill-based qualifications. To push for digital agenda, the education system need advanced teaching techniques to cultivate the next-generation of university students and startups.

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UNIVERSITIES AND STUDENTS

Universities are a centrepiece in nurturing the skills and talents required for I4.0. Hence, universities should adopt suitable learning management system and use the modern student-led learning and teaching approaches through a combination of classroom lessons, project based studies, case and scenario analysis, and internship with companies having I4.0 systems. Science-focused, AI related courses should be offered to meet growing skill demands in data analytics, AI design, IoT engineering, environmental science and precision farming. Computer science, data engineering, electronics engineering, and computational thinking in science and mathematics courses should be infused into not only computing and robotic engineering tracks but to business, finance, and actuarial science disciplines to ensure students are exposed to multidisciplinary technical fields. Universities should groom students to become professionals like data analysts and scientists, AI specialists, and software and applications developers and analysts for future recruitment possibilities. Universities should have an industry-driven, fluid and organic academic programmes, flexible modular classroom and modern pedagogy such as heutagogy (self-based learning), paragogy (peer-oriented learning) and cybergogy (virtual-based learning) to stay relevant to the industry demands. As smartphones, intelligent wearable devices and desktop computers are ubiquitous in today's world, faculties should deploy state-of-art technologies and facilities that allows students with 24/7, mobile access on the multimedia learning materials. This gives students the opportunity to learn and playback anytime, anywhere. Students can virtually interact with faculty members through social media like Facebook, WhatsApp, WeChat, Skype, Telegram, and Live Chat for better and effective learning experience.

Before leaving their intellectual ivory towers, graduates should boost their 10 future skillset, namely, complex problem solving, critical thinking, creativity, people management, coordinating with others, emotional intelligence, judgement and decision making, service orientation, negotiation and cognitive flexibility. As such skillsets are among the things that humans do better than machines, thus ensuring their relevance now and in the future (Gray, 2016). Graduates should be well prepared for the future. They should get set for new jobs that will either not exist, or such jobs that will look very differently by the time they graduate. There will be new types of jobs requiring new skills in various industries which are setup in various part of the world. Hence, they must be cross-culturally, digitally and ethically literate to handle future of works. Indeed, as leaders of tomorrow, graduates with STEM and TVET qualifications should possess not only emotional quotient, cultural quotient, intelligence quotient but also digital quotient in order to be groomed to become business leaders, innovators and technopreneurs (Dhesi, 2018).

THE ROLES OF DEVELOPMENT OF LOCAL COMPANIES AND SMES

Local companies have to be well prepared for optimal processes, technologies and solutions of I4.0 in order to ride the wave of I4.0 technologies in terms of industry convergence, breakthrough global best practices and changing customer dynamics. As I4.0 brings a lot of uncertainties and transformation, it is essential to anticipate future products and services to serve customer needs. With states supporting on technology-based education and training, industries should recruit the best and the brightest with high-tech digital skills to build strong future workforce across all levels and categories to support digital enterprises (PwC, 2016). Such graduates and non-graduates have basic technical skills to pick up new

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industry-specific skills. They have to learn, lead and build up firm capabilities. Besides, it is necessary to invest heavily in agile, high-tech IT infrastructure needed to inject advanced technologies.

While it is important to instill frugality, hard work of 996 (9am to 9pm six days), self-reliance, ethics and values, it is equally important to nurture a work culture that encourages innovation and fosters a sense of challenge. Such work culture is embedded in the organisational culture that welcomes good ideas from anybody, no matter an employee's rank. There should be a paradigm shift in thinking outside of human narrow creative window in a highly conformist society. Employees are encouraged to take measured risks, and try new things, without fearing making mistakes and facing punishments. It is necessary to change to new mind-sets as workers and staff who have been doing things the same way for many years might not see the need for change.

UPSKILLING, RESKILLING AND LIFELONG LEARNING

It is a fact that most local businesses do not want to spend much time and money on training to improve new employees' shortfalls in skills. But they have to change their mind-set in today era of digital, globalised world. It is important to ensure new hires can quickly use digital tools in every aspect of their daily activities without getting too long on-the-job training. Skilled workforce should be constantly upskilled to learn I4.0 technologies to add values to companies and customer experience. Old workers, unskilled or semi-skilled workers who cannot adapt to new role will inevitably be replaced. It is crucial to ensure that affected workers must have the ability to learn new knowledge and skills. To fast-track the learning process, it is necessary to hire talents and expatriates to manage I4.0. Digital know-how and affinity should be part of the company's DNA. With the I4.0 fast-eclipsing existing digital revolution, there is a growing demand for digital talent for MNCs and local companies. Therefore, it makes sense to attract global talent pipeline from abroad (TalentCorp, 2017). Meanwhile, all employees have to achieve delicate work-life balance and follow an ethos of lifelong learning to enhance hybrid skills mastery. As the future is uncertain, it is undoubtedly difficult to predict future skillset for any soaring career. Besides, they have to ensure good overall equipment effectiveness and future-proof operations. Future workforce have to "learn how to learn" in order to hone their digital skillsets. It is possible to experiment new methods like learning analytics, blended learning and virtual learning for effective learning. Future workers should accept agility, adaptability and flexibility with open-minded thinking to work for a sustainable future.

FUTURE RESEARCH AND DIRECTIONS

As I4.0 is an integrative, self-organised system for creating values for organisations, it is important to identify relevant research avenues for future research. The future research area is to determine which industries will be winners and losers in today's digital transformation as nobody can accurately predict the applications and feasibility, and acceptance of I4.0 technologies. The second research area is the new relationship between humans and machines in terms of work culture and ethics. Although the holy grail for smart factories is to have a "lights-out factory" which seamlessly operates without human intervention, the future role of humans should be more important than those of machines. According to Schwab

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(2016), new technologies are first and foremost tools ethically made by people and for people, and by no machines. Having said that, there is a potential issue of singularity where machines with artificial superintelligence can outsmart human capabilities. Other research areas can cover cybercrime, cybersecurity, data sharing and privacy, and interoperability standards between firms and industries (Roblek, Meško, & Krapež, 2016).

CONCLUSION

In spite of the pessimistic predictions about 4IR concern on massive disruptions almost in every industry in a non-linear way at a speed and scale unparalleled in human history, the mainstream view is optimistic that I4.0 will bring more promise of techno-utopia society where I4.0 technology will help countries make economic progress, bring comfort and happiness to the society, liberate humanity where people can be freed up for creativity. At organisational level, MNCs have made a paradigm shift in managing innovation and adopting new technologies in order to gain first-mover advantage, outpace their competitors and finally thrive in the digital economy. To achieve this, MNCs should constantly upgrade their technologies and employ highly skilled workforce through upskilling and reskilling, and reinvent their impregnable business models to ensure I4.0 technologies generate economic benefits and better customer experience. With regard to local companies who are relatively under-resourced, they have no choice but to embrace I4.0 technologies. They need to play catch-ups to remain engaged in the global supply chain dominated by MNCs. They have to maintain high competitiveness in quality, cost and delivery in order to achieve profitability and therefore make investment in I4.0 technologies. Local companies have to work harder and smarter in order to punch far above their weight to succeed in the global competition by leveraging on I4.0 technologies. They have to be transformational, competent, entrepreneurial and innovative in order to be at the forefront of the smart manufacturing systems.

For workers in the era of I4.0, it is evitable to face technological unemployment where low-skilled workers will be displaced, later lose jobs and marginalized but high skilled workers will gain new jobs for better pay and experience. In this case, displaced workers need reskilling for closing skill gap and overcoming skill mismatches in order to improve their chance of returning to the workforce or face the risk of retrenched. As robots and AI technology will be taking over routine works, unskilled and retrenched workers have to have the prospect of low-paid jobs or joblessness in the future. On the other, high-skilled workers will be in high demand for smart factory and smart office. But, they should be upskilled with relevant IT and technical knowledge and skills to stay in the jobs which offer handsome pay and job satisfaction. To push organisations to the next level, talented workforce should be sought and deployed by farsighted employers across different industries to fast-track development and transfer of technology and technical skills while reducing learning curve. It is envisaged that the advent of major the advancement and diffusion of AI, deep learning and automation technologies requires strong support from the management commitment and talented people to bring I4.0 to fruition. In the long run, all workers need to future-proof themselves against the job apocalypses and successfully ride the tidal wave of I4.0

Working closely with MNCs, industries players and high-tech organisations, government have to adopt the concept of e-government, establish I4.0 policies and practices address issues of high-tech infrastructures and industrial upgrading and re-structuring. Policymakers need to work out initiatives to support the capital investment by high-tech MNCs and creation of high-tech industries through incentives and

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grants. It is true that most countries adopt this I4.0 technologies in order to inject new energy to drive the next wave of high-tech growth and technology progress which have significant spillover effects on economic growth and social development. To ensure I4.0 can be promoted, there be an ecosystem that allows creativity and innovation from risk-taking and leading experts of I4.0. The government can create public and private sector collaboration platform so that cross-industry industry can share technical knowhow and R&D technology to promote transfer of technology and skills. In this way, they can learn and stay above the curve and also navigate triumphantly in this fast-changing technological landscape. Policymakers need to address the address the issues of consumption, social inequality, skill shortages, risk of cybercrime and technological unemployment. In this aspect, the policymakers need to think beyond the Gini coefficients and include measures like social welfare subsidies and universal basic income distribution to address the absolute income gap and social issues.

It is absolutely necessary for governments work with the universities to address the issues of skill shortages and mismatches by offer relevant development programmes. Both public and private universities have to take cognizance of skill requirements to narrow down the huge disparity between what is learnt and the skills needed by employers. In other words, universities have to ensure that the supply of supply of graduates meet the industry demand and there are job opportunities available in the market. All universities have to promote deep integration of AI and education so that a more open and flexible education will be equal and suitable for everyone. Graduates will be more marketable in their technical profession if they have relevant I4.0 skills. In the era of I4.0, it is obsoletely necessary to produce tech-savvy graduates who are keen and able to adapt and learn new technologies like computer programming, object coding, app development, 3D printing, robotics, and data analytics. Besides, universities should churn out graduates who are transformational, competent, entrepreneurial and innovative in tacking complex problem and working out automated solutions. Policymakers play a critical in the development between technologies and human development. Without proper human capital development, it is difficult to support the advances in technologies and innovation. In fact, the success of any country in meeting the challenges I4.0 lies at the heart of how human capital of future generations. Going forward, all stakeholders like public institutions, private sectors, captains of industries, entrepreneurs, civil society and academia from different countries need to collaboratively and ethically work together to ensure not only I4.0 deliver the economic potential and long-term benefits of society and workers but also remain human-centred, giving humans more time and freedom for a better, safer and happy life in the future. It is envisioned that there will be a closely intertwined human-robot interaction and easy-to-use synergistic automation that pairs brute force algorithms with human ingenuity. Under such situation, the development of I4.0 technologies of today and tomorrow should bring benefits to the mankind. This means, people (human) should be in decision making loop where humans can exercise judgement and definitely have a final say on all important decisions in the CPS system. Hence, it makes sense to intensify efforts to overcome major disruptions and break down the barriers of implementation like cost of investment, cost of running I4.0 technologies and technical standards and challenges, besides handling massive resistance to change from relevant stakeholders. Although there are no one-size-fits-all solutions, steps and initiatives should be taken to ensure the development of I4.0 technologies of today and tomorrow can bring greater benefits for all stakeholders especially countries, societies, organisations and workers.

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KEY TERMS AND DEFINITIONS

Artificial Intelligence (AI): The theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages.

Automation: The use or introduction of automatic machine, robotics equipment in a manufacturing to improve efficiency and flexibility.

Industry 4.0: A current trend of web-based automation using cyber-physical systems, Internet of Things, artificial intelligence and cloud competing that enables self-monitoring and self-optimization on the manufacturing network.

Job Creation: A provision of new opportunities for paid employment, especially for those who are unemployed.

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Job Displacement: An involuntary job loss due to economic factors such as economic downturns or structural change in organizations.

Reskilling: An improvement effort especially displaced employees an unemployed person to learn new knowledge and skills to assume new jobs.

Skillset: A individual's range of knowledge, skills, and abilities.

STEM: An education system that focuses on science, technology, engineering, and mathematics disciplines for tertiary studies.

TVET: A technical and vocational education training (TVET) that equip non-academic youth with knowledge and skills for employment.

Upskilling: An improvement effort of employees to learn additional skills in their profession.

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Chapter 4
A Framework Development Effort for Using Online Communities in an Open Innovation Understanding

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ABSTRACT

This chapter brings online communities, open innovation, and Industry 4.0 concepts together to build a framework for using online communities in an open innovation understanding in Industry 4.0 context. While online community and open innovation field of studies are being studied for a period of time, Industry 4.0 is rather a new topic which needs further understanding. Literature lacks studies that suggest a framework, especially integrating cloud-based design manufacturing and social product development concepts which are related to Industry 4.0. This study tries to fill in this gap by explaining how online open innovation communities can be created in Industry 4.0 context, what is needed for user participation, motivation, interaction, and what concepts that a company can use to build a collaborative culture and innovative outcomes.

INTRODUCTION

In the past, innovation in an organizational setting was considered as closed innovation approach. A firm would innovate with its own resources in its own boundaries by relying on its own employees. Nowadays, open innovation (OI) became a hot topic which boundaries between a firm and its innovation environment is more porous (Chesbrough, 2003). It allows ideas, information, knowledge and technologies to flow in and out of companies. It is different from linear innovation model; rather it can be identified as a systemic, open and user-centric innovation model which builds on highly interactive multi-actor

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innovation networks (Hafkesbrink and Schroll, 2011) that connects technology and people around an innovation ecosystem (Hafkesbrink, Hoppe and Schlichter, 2010). OI is different from closed innovation which the focus is on protecting knowledge, not allowing any knowledge leakage. A company who adapts OI approach doesn't solely rely on their own knowledge base and capabilites, they also look actively for knowledge outside of its own boundaries and if applicable, they use others' capabilities.

Web 2.0 is defined as "a collection of open-source, interactive and user-controlled online applications expanding the experiences, knowledge and market power of the users as participants in business and social processes for supporting the creation of informal users' networks, facilitating the flow of ideas and knowledge by allowing the efficient generation, dissemination, sharing and editing/refining of informational content" (Constantinides and Fountain, 2008:232-233). It has changed customers' roles from passive objects to active participants (Tapscott and Williams, 2006). An online (virtual) community (OC) is "a group of people who exchange words and ideas through the mediation of computer bulletin boards and networks (Rheingold, 1994:57-58). In these types of communities, there are valuable interactions which might have a big impact on business strategy and operations by being a source of threats and/or opportunities (Williams and Cothrel, 2000). Companies can use online communities to bring in new resources to accelerate the open innovation process (Lee, Bahgeri and Jin, 2016). External contributors (e.g., experts, scientists, potential customers) in OCs can provide both market-related and scientific knowledge. These platforms are important for companies, because there is an opportunity to access valuable knowledge at a low cost or without any cost (i.e. open source). To achieve this, companies need various analytics tools to support design, manufacturing and services (ibid) which can be developed by Industry 4.0 (I40) practices and tools.

I40 refers to the computerization of industrial products, services and processes. It is a collective term for technologies and concepts of horizontal and vertical value chains which covers the connection of people, machines and systems (Gilchrist, 2016). It grounds on a revolution idea. Historically, there are three main industrial revolutions. First one was triggered by steam engine and mechanical production was the main outcome. Second one was fostered by electricity and assembly line. It enabled mass production which resulted as industrial growing. Third one was catalysed by the computation and internet. It is defined as a digital revolution which enabled on-time interactions by nearly removing the boundaries between people and organizations. The fourth industrial revolution term, namely industry 4.0, was coined in Hannover Fair in Germany in 2011. It creates a world in which virtual and physical systems of manufacturing globally cooperate with each other in a flexible way by enabling smart factories (Schwab, 2016). OI might be addressed as a sub-concept of I40 which is a new system in the development of products and services (Lasi et al., 2014). For instance, Schumacher et. al (2016) measured I40 maturity of industrial enterprises which consist open innovation under culture dimension.

The aim of this chapter is to suggest a framework for companies on how to use OCs in OI understanding in I40 context. The remainder of this study is as follows: First, OC is defined in a Web 2.0 setting. After that, OI is explained in I40 context, regarding its knowledge sourcing concept. Finally, Creation-Participation-Motivation-Interaction-Collaboration-Innovation (CPMICI) Framework is defined and explained. In this framework, first, how to create an online OI community and what is needed for user participation, motivation, interaction are addressed. Then, what concepts that a company can use to build a collaborative culture and innovative outcomes are explained.

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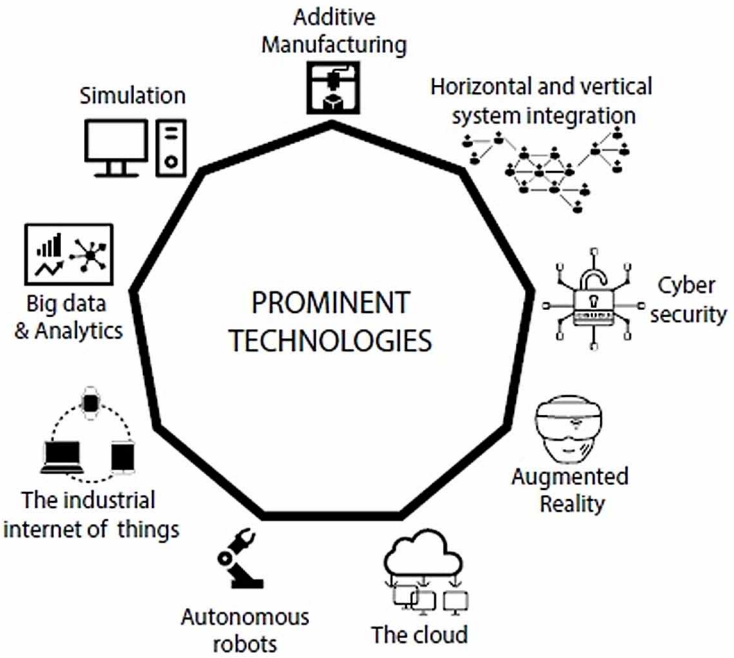
ONLINE COMMUNITY USAGE FOR OPEN INNOVATION PURPOSES

Most literature on OI has focused physical strategies and platforms such as idea contests (Terwiesch & Xu, 2008). However, increasing use of Web 2.0 platforms has attracted both individuals and companies. These kinds of platforms provide a place where users, experts, scientists and companies come together, interact and collaborate. Online communities (OCs) are one example of Web 2.0 and they offer information sharing in a business context (Lu and Hsiao, 2010) which produce informational and social support for users in the community (Bugshan, 2015). They are important source of innovations (Von Hippel, 2005). They have some benefits for organizations. For instance, OCs give opportunities to create customer loyalty by obtaining feedback and information on customer needs and requirements and improving customer service. They also increase to access to expert knowledge and enable information exchange with highly credible sources. They increase productivity by improving the quality of knowledge. They are also effective virtual platforms for idea creation, enhanced problem solving and novel product innovations. Saving time during information seeking and sharing is another valuable outcome (Millen, Fontaine and Muller, 2002).

Figure 1 is adapted from Iriberri and Leroy's (2009) study which they reviewed online community success factors and summarized them in a figure. Authors titled them as management, psychology, sociology, and computer science and information systems. For this study, I40 is added as a context factor. It allows companies to benefit from mass personalization, mass production (high-volume standardiza-

Figure 1. Suggested online OI community success factors in an Industry 4.0 framework
Source: (Adapted from Iriberri and Leroy, 2009)



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tion) and mass customization (Yao and Lin, 2016). Furthermore, smart manufacturing/smart factories can collect up-to-date information on physical objects and processes via the Internet of Things/Cyber Physical Systems, thus enhancing productivity and flexibility for existing mass manufacturing processes. This has great potential to give customers the ability to select from and/or contribute to the product or service attributes that matter most to them (ibid). For instance, in the context of the Industrial Internet of Things (IIoT), customers are collaborative partners and co-designers, which are integrated via open source or open innovation processes (Kiel et al., 2016). Moreover, IoT can be used to glue physical space and cyber space and, cloud manufacturing to provide various elastic services, so that the on-demand workspace, interaction, information sharing or collective problem solving are enabled (Yang et al., 2017). I40 holds the promise of enabling last-minute changes to production and delivering the ability to respond flexibly to disruptions and failures (ibid) which might provide strong background for OI approach. All these features are the main reasons for integrating I40 here as an upper-system. As mentioned below, it helps organizations to be more productive through value chain; so that using I40 tools might increase the effectiveness of OI processes and outcomes.

A firm can source knowledge by creating an OI community or it can also use existing communities. Existing ones (e.g. forums) are created by non-company partners such as individuals while online OI communities are created by companies. Often a company plays a central role in an OC as an solution seeker towards achieving company-level objectives. Users are solvers who have intrinsic and extrinsic motivations to participate in these kinds of communities and they participate to solve some innovation problems (Lakhani and Jeppesen, 2007). They can act as a source for learning and producing external ideas or even solutions for companies (Chesbrough, 2006; Jeppesen and Frederiksen, 2006). For instance, P&G has launched its *Connect & Develop* program. It has developed a collaborative platform which individuals and companies can share their ideas. It created new partnerships and product development solutions that resulted as new innovative products and business growth (Huston and Sakkab, 2006).

OCs can also be a source of creativity, expertise and collective intelligence (Mount and Martinez, 2014). They are a cost-effictive way of new product development for companies addressing both time and money as costs (Bugshan, 2015). Launching a product before competitors at low-cost can foster competitiveness and innovation potential (Battistella and Nonino, 2012). Creativity and efficiency of innovativeness can be enhanced if the community is designed according to users' needs. Furthermore, in an OI setting, "if we build it, they will come" approach does not apply (Antikainen et al., 2010). It requires a process-based understanding which includes motivational support for effectiveness of the platform. For instance, open and constructive atmosphere can be a positive motivational factor to make ideation process easier (ibid). In fact, a community is not just a group of people. It is the sum of people, their motivations, roles, interactions and so on. These factors create a synergistic and collaborative culture that cultivate innovative outcomes.

OPEN INNOVATION IN AN INDUSTRY 4.0 CONTEXT

Each organization is a part of a knowledge and learning environment; a wider innovation ecosystem which it can import knowledge, process it and export innovative outcomes such as products. An organization can also create new knowledge to be used for future innovative outcomes and license out, spin out technologies which are not applicable of its business model. In this manner, organizations are in need of an OI understanding if they want to survive in this complex, expanding and distributed environment.

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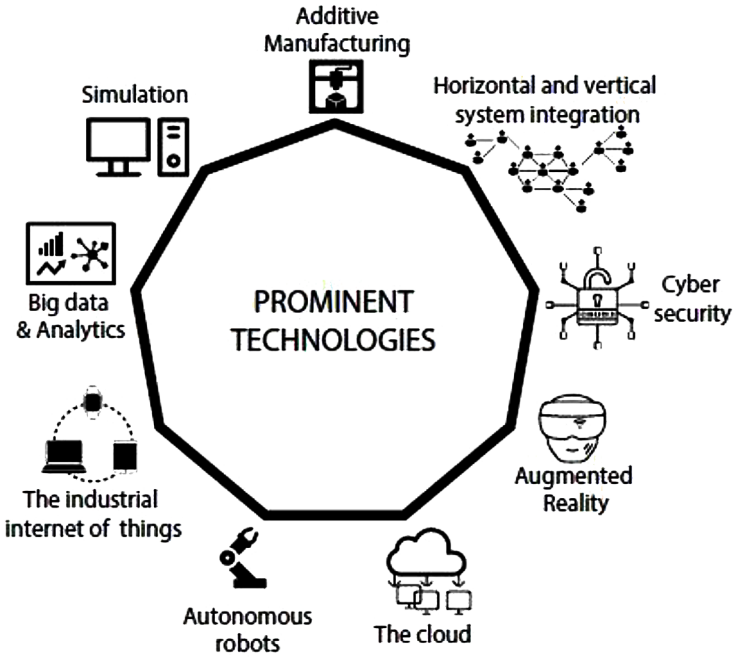
Thus, they need to manage idea, information, knowledge and technology licencing in and out related processes, practices and tools if they want to actively participate in this ecosystem. They also need to decide which communities they can use for innovation processes. This notion brings in using OI approach while gathering knowledge from OCs and integrating it in the whole process with I40 tools. To understand this, a question must be answered in the first hand: "What is I40?"

I40 is an umbrella concept, as mentioned above, which includes "the implementation of cyber-physical systems along the entire value chain and digitalization of products and processes" (Burrmeister, Lüttgens and Miller, 2016:124). It is a holistic system that brings prominents technologies such as big data and analytics, simulation, additive manufacturing together (Saucedo-Martínez et al., 2017). Its growth and impact depend on highly automated manufacturing processes that require less and less traditional, more modernized manufacturing jobs. Along with this, customers would experience manufacturing applications driven by artificial intelligence (AI), machine learning, and automated technologies which companies gauge customer requirements with the help of data science (Umachandran et al., 2019). Hence, product design and development processes will be affected by all these developments in the near future.

There are two main design principles of Industry 4.0, namely interoperability and consciousness (Qin, Liu and Grosvenor, 2016). First one refers to the integration of manufacturing system, product chain and value networks. Interoperability itself consists of three types of integration: (1) horizontal integration whihc is the integration over the business value networks; (2) end-to-end integration which covers product chain, and (3) vertical integration that represents manufacturing system integration. All these integration types include digitalization, communication, standardization, flexibility, real-time responsibility, and customizability concepts, and their interoperability. Consciousness is comprised by

Figure 2. Group technologies and tools for Industry 4.0
Source: (Saucedo-Martínez et al., 2017)



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predictive maintenance, decision making, intelligent presentation, self-aware, self-optimization and self-configuration (ibid) which forms on 5C architecture levels of I40 explanied below.

I40 generally covers four aspects namely factory, business, products and customer. First aspect can be described as 'smart factory' which all technological components are connected to each other. The businesses are self-organized entities which are connected to each other in a network understanding. Products, in this concept, are 'smart products' which are embedded with sensors, identifiable components, and processors that carry information and knowledge to convey the functional guidance of customers and transmits their feedbacks to the manufacturing system. These smart products allow customers to change their order and ideas at any time during production process (Qin, Liu and Grosvenor, 2016). Therefore, it enables an inter-connected system which includes smart customer applications, smart products, a self-organized business network and smart factory and its components.

The core idea of I40 is the implementation of cyber-physical systems (CPS)[1] for industrial production which includes networks of microcomputers, sensors and actuators embedded in materials, machines or products that have been connected along the value chain (Porter and Heppelmann, 2014; Rudtsch et al., 2014; cited by Burrmeister, Lüttgens and Miller, 2016). In an organizational understanding, it refers to a broad concept that brings a conscious CPS system and various tools together. It also creates a necessity for digitalization as a requisite. It allows gathering real-time data, doing optimized high speed digital analysis, intelligent controlling of the production environment and processes, synchronizing product-service combinations throughly. It also offers beneficial outcomes for companies such as value-added services, flexible processes, higher equipment efficiency, shorter time to market, better handling of complex products, manufacturing on demand and so on (Burrmeister, Lüttgens and Miller, 2016). Hence, I40 provides tools that can be used for valuable business related outcomes such as innovation.

OI adresses an innovation approach, while Industry 4.0 is an umbrella concept which covers entire value chain by integrating digitalization and related concepts such as smart factory, internet of things (IoT), artificial intelligence (AI), cyber physical systems (CPS) etc. It enables "a fusion of the virtual

Table 1. 5C Architecture for Implementation of Industry 4.0

5C Architecture	Main Attribute	Main Function	Main Focus
I. Connection Level	Communicable	Hardware Connection	Main focus is on hardware development which is accomplished by the sensor network and wireless communication, and the other four levels, especially paying attention to the controlling system and software implementation.
II. Conversion Level	Informational	Information Discovery	Main focus is on raw data transformation into useful information by using data analysis Technologies
III. Cyber Level	Controllable	Automated System	Main focus is on controlling the entire network via the cyber-physical-systems (CPS)
IV. Cognition Level	Early-aware	Predictive Maintenance	Main focus is on engaging the artificial intelligence in the network which are considered as future attributes of manufacturing and lower level of I40.
V. Configuration Level	Self-configure	Intelligent Production	Main focus is same as Cognition Level, but main differences lie on the feautures of I40. This level focuses on upper levelled features of I40.

Source: (Adapted from Qin, Liu and Grosvenor, 2016)

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and the physical world" (Prause, 2015:159). I40 necessarily involves innovation in manufacturing methods; thus, OI processes could be a very interesting topic to study in I40 which lacks of scholarly studies (Piccarozzi, Aquilani and Gatti, 2018). OI and I40 alltogether might provide a strong background to the production process itself with both physical and virtual aspects. For instance, Lasi et al. (2014) indicates that, in an I40 context where product and service development are individualized, OI is of outstanding importance. A recent study states that to survive in the Industry 4.0 world, companies would need to successfully implement open innovation aproach, thus some Industy 4.0 products and services will be developed as open innovations (Buhr, 2017). In another study, authors mentioned that they have seen no instances of using crowdsourcing or other open innovation mechanisms for I40 in their sample regarding especially business model innovations (Burmeister, Lüttgens and Piller, 2016).

Cloud-based design and manufacturing (CBDM) and social product development (SPD) might be adressed regarding smart manufacturing concept. SPD is "the use of social computing technologies, tools, and media, influencing the product life cycle at any stage through the use of a defined and qualified crowd with the goal of enhancing the value of communication. It is not developing social products, rather it is developing products socially" (Peterson and Schaefer, 2014:1-2). Crowdsourcing, mass collaboration, open innovation, and CBDM are some of the tenants of SPD (Thames and Shaefer, 2016). CBDM, as a sub-concept of SPD, on the other hand, is "a product development model that enables collective open innovation and rapid product development with minimum costs through social networking and crowd-sourcing platforms coupled with shared service pools of design and manufacturing resources and components" (Shaefer et al., 2012:8) and "is characterized by on-demand self-service, ubiquitous access to networked data, rapid scalability, resource pooling and virtualization" (Peterson and Schaefer, 2014:8). SPD's goal is to enhance the value of communication through creating relationships, establishing communities, and encouraging collaboration. Thus, a defined and qualified crowd is needed. The development process itself is open to any contributions for product life cycle at any stage. Since it is developing products 'socially'; social computing technologies are needed to create and maintain virtual communities (ibid). SPD and CBDM might provide technical background for personalized AI enhanced product/service design and development. This means an on-demand production understanding which comes along with a tailored approach and companies can use online OI communities for this purpose.

A typical online OI community can comprise of employees, managers, experts, customers, scientists and other participants. This community requires managing innovation with a collaborative and cooperative OI understanding. A recent study (Knoke, Missikoff and Thoben, 2017) addresses some criterias (namely orientations) to evaluate concepts towards stable cooperative innovation processes in virtual organisations: network, project, management, partner and IT orientations. While it mentions virtual organizations, it can also be applied to virtual communities which are created by companies to involve partners in product/service innovations. For this manner, a consistent effort is necessary to continuously involve all potential partners who are mentioned above. Since it would be a product/service development community in general; project management tools, methods and understanding are needed. Therefore, a business objective would be set and collective knowledge production process should be managed by integrating the partners into the process. For maintaining this virtual environment, advanced technological solutions are needed by involving I40 tools along with Web 2.0 technologies.

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CPMICI FRAMEWORK: WHAT IS IT AND HOW TO APPLY IT IN AN INDUSTRY 4.0 CONTEXT?

OCs can take many forms such as websites, instant messaging tools (Bishop, 2003). In this chapter, our focus is on websites which enable idea, information and knowledge exchange in terms of innovation-related outputs designed with Web 2.0 and more current internet technologies in a I40 context. Suggesting a framework for creating and maintaining an OC for OI practices in an I40 context is the main outcome of this study[2].

OI mainly grounds on idea, information and knowledge exchange. It covers crowdsourcing, co-creation and other related activities. In this manner, the focal company imports useful ideas, information and knowledge from outside of its own boundaries as well as exports some of its own outside of its own boundaries. This understanding reflects as an approach of innovation that a company can gather raw data from some current practices such as using big data and crowdsourcing ideas of customers and/or potential customers, experts, scientists and other partners through online platforms and communities. The stage after this, in general, is to convert these data into valuable knowledge. Accordingly, a I40 integrated OI based OC can be created for this purpose. After that, participation should be encouraged. Some motivation factors are needed (such as monetary or non-monetary rewards) in this stage. When motivation factors trigger participants, they will interact each other. This interaction can lead to collaboration and in the end, innovation-related outcome (which is the desired output) might provide efficient solutions for the innovation itself. I40 reflects as a facilitator for this framework.

Creation

Information technology and, social media network advancement and adoption are two concepts which have influences on consumers' perceptions on product innovation (Lee et. al, 2015). This concepts bring in the effectiveness of the platform and the power of the community created. To achive this, first proposed component of the framework (i.e. creation) might be explained considering many factors.

The creation of a community generally covers three aspects which are named as purpose, technology and people (Irriberri and Leroy, 2009). Purpose, for instance, can be addressed as to achive successful innovative outcomes such as creating innovative product collaboratively with external partners. Technology is the platform which provides a virtual place to exchange ideas, information and knowledge. People is the participants/contributers (i.e. members) of the community and platform. Creation of the community would likely to ground on the success factors mentioned (i.e., management, psychology, computer science and informations systems and Industry 4.0).

When creating an online community for OI purposes, the platform and its features should be carefully formed. For instance, user needs and requests should be considered to gather information effectively and easily. A community, in general, is "a voluntary association of actors, typically lacking in *a priori* common organizational affiliation (i.e. not working for the same firm) but united by a shared instrumental goal" (Glaser, 2001; cited by West and Lakhani, 2008:224). In this suggested framework, main goal of the community is the creation of innovation outcome in an OI setting. A group of individuals, namely users of the community, will become a part of it. So that, some aspects should be considered such as knowledge sharing, intellectual property and commercialization opportunities.

Usability is one of the main concepts. It covers software's role as a medium and a place for social integration. It consists of four components in general (Preece, 2001): (1) dialogue and social integra-

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tion support, (2) information design, (3) navigating through the platform easily, and (4) easy access. In online OI communities, these four components are really important because of the purpose itself. Product development and innovative outcome(s) are main desired outputs, so that the platform should be user-friendly to encourage knowledge sharing. Task-technology fit is another factor which can be mentioned under the usability. A task is generally an innovation problem to be solved by the users of the community. The platform should have provide the technology infrastucture, so that task and technology can fit. Otherwise, members will be demotivated.

Privacy, safety and intellectual property (IP) issues can be mentioned as well. "Will the platform be designed as an open-source platform or will it involve IP rights?" These kinds of quiestions can be asked and answered before creating the platform and attracting the users. For instance, a recent study (Bauer, Franke and Tuertscher, 2016) argues that OCs not only generate and openly share IP, they also foster and protect IP under specific circumstances. They can foster IP by positive copying and preclude by negative copying. Moreover, if the platform offers features that facilitate transparency, activate members, and empower them to self-organize; norm based IP systems (i.e. a system of social norms that regulates IP rights within a collective of actors) are likely to emerge and become established in the community. Furthermore, if members strongly identify with the community, norm-based IP systems will likely to be more effective. Hence, asking the crowd if there should be a formal/informal IP system or solely open-source system might be the best way of deciding IP issues.

Participation

Second component suggested is named as "participation". Posting a message to a bulletin board or joining a sub-community can be a sign of participation as being an individual action (Bishop, 2007). People tend to engage in OCs for participating in co-creation and innovation (Seraj, 2012). The virtual platforms provide a promising source of innovations (Füller, Jawecki and Mühlbacher, 2006) which derived from the people who can be called 'innovators'[3], 'educators'[4] and 'challengers'[5] (Seraj, 2012). Members who does not participate in any actions are called lurkers which are not a form of membership that companies want. They are in need of active participants who share ideas, information and knowledge of their expertise or opinions on the subject matter. The participation component mostly lies on computer science and information systems, and psychological aspects. All the issues mentioned in the creation section apply here. Easily usable platforms are motivational when it comes to social computing activities and knowledge sharing. Moreover, each member can have different motives for participation. For instance, Lakhani and Jeppesen (2007) indicated that solvers in crowdsourcing communities desires to acquire new skills and learn. Brabham (2008) addressed the desire for employement as a participation motive as well as entrepreneurship opportunities.

Motivation

Third component is named as "motivation" which grounds on psychological factors. Motivations generally consist of two aspects: intrinsic and extrinsic. First one refers to individual's self-motivation about completing an activity (e.g. solving an innovation problem) for its inherent satisfaction (Lee et al., 2015). For instance, intrinsic enjoyment of contributing which means fun, enjoyment and level of the task that the user think it is interesting (i.e. being pleasurable to work on) is an intrinsic motivation. Additionaly, self-interest can be addressed as an intrinsic motional factor. Moreover, an individual can

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gain satisfaction in completing the innovation related task (Frey, Lüthje and Haar, 2011) which is also a psychological factor. Extrinsic motivation comes from the outer factors such as monetary rewards which means financial gains and compensations. When a virtual community provides rewards for contributions, this in return, seems to increase the number of messages posted by community members, making it more active and more successful (Leimeister, Sidiras and Krcmar, 2004). For instance, some winning crowdsourcing solutions offered by companies rewards solvers of their innovation problem with money or similar financial compensations (Yang, Adamic and Ackerman, 2008). These gains are effective for encouraging widespread participation in crowdsourcing initiatives and improving the appropriateness of the new product ideas (Acar, 2018). There is also non-monetary rewards that can be drivers for participating in these kinds of communities. For instance, a reputation-point or social status enhancement based membership system can increase the willingness of participation (DiPalantino and Vojnovic, 2009) and knowledge sharing behavior. Moreover, as mentioned above, employement and entrepreneurship opportunities can motivate users much more in OI communities. A user can design a product prototype on her/his computer and print it via 3D printer, share the codes/the digitized version of it in the community. The focal compny can adapt it in a short time, develop and serve it to the market. A motivational system can be designed and created both for users and the focal company including monetary and non-monetary rewards to encourage people to participate in such communities for I40 purposes.

Interaction

Fourth component of the suggested framework is "interaction" which is one of the success factors of virtual communities, i.e. encouraging interaction between members (Leimeister, Sidiras and Krcmar, 2004). Socialization can be addressed as the main desire of an individual who wants to become a part of a community (Bishop, 2007). Moreover, these kinds of communities also include communication aspect in an informal manner. The platform provides a social space where individuals, whom of specific expertise or not, can interact each other by posting messages etc. This social web platform creates a place where the users long for a participation according their needs and desires (Rheingold, 2000). It gives them an opportunity to interact in a virtual community where a group of people exist. It triggers learning from each other and fullfills their need of socializing and communication.

The socialization and communication also helps us to understand the underlying sociological reasoning of interaction behaviors. For instance, Social Exchange Theory (Blau, 1964) explains the behaviors of individuals who interact each other that expect social rewards such as status, respect, reputation. This theory can shed a light on the motivation of interacting and sharing knowledge in OCs. The people who behave accordingly usually do this for fun, enjoyment and self-satisfaction as indicated in the motivation component. Here, social recognition can be mentioned in a sociological perspective. It posits that users' knowledge sharing behaviors are valued and they are recognized in the group. Furthermore, individuals who interact each other can give and take feedbacks to each other. They can compliment one another's contribution and give complementary information which boosts interaction. These all favors interaction behaviors on knowledge-related topics and also increase socialization and communication in the community.

Human-computer interaction is a another term which can be mentioned here. It was formed in late 1970s, used for understanding and designing of different relationships between people and computers. Its main concern was the usability of the computer, that being said 'the fit between user and machine'.

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A cognitive revolution reflected a shift in this concept in 1980s and 1990s. The communication between people and computers has gained much attention with the engagement of researchers in social sciences such as Sociology and Anthropology. By 2000s, 'human in a digital future' concept has become the central topic in line with the developments of the way and the purpose(s) of using computers. Since computer technologies are not neutral, many aspects of them (e.g., social, cultural, human) are needed to be considered (Harper et al., 2008). This will also be useful for user-centered design and research. It will reflect in business management as it will include product/service design and its iteration, (rapid) prototyping and testing. Interactions between people as well as people and, computers, data and machines have potential to be a hot topic in near future, especially in product development processes. This is not limited to interaction, a cooperation comes along especially in product design which individuals outside of the focal company can also be included in the system, especially when designing a consumer good. This reflects as an interactive, embedded and cooperative holistic system where companies and people interact each other in a creative manner.

Collaboration

Fifth component is "collaboration". It refers to knowledge collaboration which means "sharing, transfering, accumulation, transformation, and co-creation of knowledge that involves individual acts of offering knowledge to others as well as adding to, recombining, modifying, and integrating knowledge that others have contributed" (Faraj, Jarvenpaa and Majchrzak, 2011:1224). A recent study claims that "collaboration" is at the heart of most challenges in Industry 4.0 (Camarinha-Matos, Fornasiero and Afsarmanesh, 2017).

Online communities have a feature that individuals can solve problems and create content (Bishop, 2007). This would lead to collaboration and accordingly collaborative culture. In online communities, stong ties are not needed. Actually, 'the strength of weak ties' notion generally applies here. The virtual community provides a free of hierarchy space to individuals who usually do not have existing social relationships before being a participant of these kinds of platforms. It gives them the opportunity to collaborate on innovative knowledge which traditional organizational structures generally do not provide.

In this section some concepts can be mentioned. Group identity is one them which is a social psychology term. It means "a shared understanding among group members regarding what belonging to the group means" (Wasko and Faraj, 2005; cited by Kim, Lee and Lee, 2019:109-110). A group of participants work together and develop shared rules, norms, common visions etc in time (Ransbotham aand Kane, 2011). This would lead role understanding and group identity. As Ren et al. (2012:842) argues that "adding social or group features to a company's website does not guarantee a vibrant community"; connecting members together, building strong attachment with some mechanisms and creating a space where group identity can easily be constituted is crucial for affective collaboration.

Social capital might be addressed as another concept. It refers to "resources embedded in a social structure that are accessed and/or mobilized in purposive action" (Lin, 2001:29). This concept is used for explaning some pro-social behaviors such as collective action, community involvement (Wasko and Faraj, 2005). Here it might represent motivational background for collaboration between users. Such communites should be designed to foster social capital among members. The focal company would control the community, set the rules and motivate users to participate and collaborate. It should be aware of the fact that over-control can stifle collaboration and interaction within the community which would

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result as the losing members, decreasing interaction and collaboration, finally decreasing creative and innovative product ideas and designs.

Online communities augment customer collaboration by helping firms to engage customers in conversations to gather both individual and social knowledge. Moreover, the nature of the collaboration is deep/rich in these types of platforms (Sawhney, Verona and Prandelli, 2005). Collaboration activities in these platforms generally result in supporting new product development by having positive impact on both the content and process dimensions of knowledge. Moreover, where it is virtually impossible for a user to detect and resolve a problem, a collective effort makes the task feasible (Bauer, Franke and Tuertscher, 2016). This would result as collaborative action and culture.

Innovation

Last, namely sixth, component is "innovation". While the suggested name is innovation, it refers to the possible innovative outcome such as product innovation idea and/or design. Each innovation approach (i.e., open innovation, user innovation) generally aims to gather knowledge from external partners for possible beneficial innovation related outputs. While each one has a different meaning, they posit a paradigm shift in the innovation concept itself by indicating that the boundries of the companies are more porous. User innovation is one of the most researched part of open innovation (Gassmann, Enkel and Chesbrough, 2010) which users are seen as active creators of innovations; whereas OI is a wider approach that includes various external contributors as well as outbound innovation activities such as free-revealing of intellectual properties.

OCs can be used both front-end stages of product development process (i.e., idea generation and concept development stages) and back-end stages of the process (i.e., product design and testing). In the suggested framework, this component mainly grounds on management and I40 factors. SPD and CBDM tools can provide efficient design and manufacturing processes as well as prototyping. For instance, individuals of expertise can share their computer aided design codes in the platform. The company can source it, transform it into an innovation related input (e.g. product innovation) and put it in the design and manufacturing process by using some analytic tools.

Below, there is a table of the summary of the keywords and terms mentioned in related sections. It represents the suggested framework concepts of this study.

Table 2. Summary of Proposed CPMICI Framework

Component	Management	Psychology	Sociology	Computer Science & IS	Industry 4.0
Creation	Open innovation approach (crowdsourcing, knowledge sourcing, outside-in open innovation), product innovation, collaborative innovation, user innovation	Motivational factors (intrinsic enjoyment, monetary rewards, non-monetary rewards)	Group identity, colloborative culture, social capital	Web 2.0 tools, Task-technology fit	Social product development, cloud-based design manufacturing
Participation					
Motivation					
Interaction					
Collaboration					
Innovation					

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CONCLUDING REMARKS AND DISCUSSION

While online community (OC) literature is rather a mature field of study, each three (namely OC, OI I40) are open to any further contributions. There is a lack of research in terms of conceptual and emprical studies which brings these three concepts together. The aim of this study is to bring them together by suggestion a framework for both scholars and practitioners.

Literature suggests that Web 2.0 and digitalization are background concepts of OC, OI and I40. Especially, digitalization is a driving force for companies which plans to integrate I40 in their manufacturing system. Innovation is a part of manufacturing operations which facilitates valuable outcomes resulting in competitive advantage. It also increases knowledge sharing activities, collaboration, absorptive capacity and so on. Nowadays, innovation ecosystems are frequently mentioned which create systems where companies can give and take ideas, information, knowledge and technologies. An OI approach provides a setting for these kinds of activities. As is; while OI indicates an innovation approach, OCs happen to be a virtual platform where companies can benefit from these activities. I40, on the other hand, grounds as the system where technologies are intergrated in it both in the physical and the virtual company.

Companies can create OCs where individuals of expertise or not can share their ideas, information, knowledge and technologies (i.e. virtual product that they develped in their house and offices via their computers and mobile devices). In line with this, a creation component can be included as a first component of the suggested framework. Moreover, the platform should be designed accordingly so that knowledge sharing by users and knowledge gathering by companies can be easily done. To achive this, computer science and information systems, as well as psychology, sociology, management (i.e. platform creation by the focal company) and I40 concepts should be included as success factors. For instance, if the platform is designed with I40 technologies, social poduct development process might result more effectively.

The framework also consist of another component which is named as participation. The reasoning to name it before motivation is that; first participation should be encouraged and then users should be motivated to post codes, messages, write comments etc. This component grounds especially on psychological factors and, computer science and information systems that provide a platform which can easily be used with the tools that users need. These all would increase the participation as well as the promotion of the community. When more people hear about it, more of them would intend to participate in.

Third component is motivation which both intrinsic and extrinsic motivations of individuals are mentioned under this section. Psychology provides a strong background for these types of motivations. For instance, crowdsourcing platforms are generally open-source knowledge platforms where companies and individuals both take part in on non-monetary incentives and rewards such as free-information gathering (on company side) and enjoyment of solving problems (on individual side). Social product development tools facilitates these types of activities where I40 technology integration becomes crucial. Interaction is the fourth component of the suggessted framework. It grounds on sociology (i.e. social psychology) where group understanding becomes important. Colloboration is the fifth component which derives from interaction. Here, a degree of engagement of the platform is needed. The last component is named as innovation. While innovation happens in the company, here it refers to an outcome which can result in an innovative output such as product innovation or service innovation idea, design or a process innovation. This component grounds on management, computer science and information systems as well as I40.

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CPMICI framework might provide a holistic approach to create and maintain OCs which serve for innovation outputs in an OI setting. It can facilitate the creation of these kinds of platforms and allow the integration of I40 technologies for design and manufacturing processes. On-time data and information might provide useful feedbacks from external contributors where they can share valuable ideas and information as well as knowledge of expertise. A specific platform might be useful to gather these data and information in a pool and benefit from it for innovation related activities.

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KEY TERMS AND DEFINITIONS

Cloud-Based Design and Manufacturing: A product development model that enables collective open innovation and rapid product development with minimum costs through social networking and crowd-sourcing platforms coupled with shared service pools of design and manufacturing resources and components.

Digitalization: The use of digital technologies to move into a digital business undertanding.

Industry 4.0: The implementation of cyber-physical systems along the entire value chain and digitalization of products and processes in a company.

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Online Communities: Virtual communites that allow information sharing in a business context which members interact with each other primarily via the internet.

Open Innovation: An innovation approach that allows ideas, information, knowledge, and technologies to flow in and out of companies.

Social Product Development: The use of social computing technologies, tools, and media at any stage of developing products.

User Innovation: An innovation undertanding which innovations are done by intermediate users or consumer users.

ENDNOTES

1 CPS is "systems of collaborating computational entities which are in intensive connection with the surrounding physical world and its on-going processes, providing and using, at the same time, data-accessing and data-processing services available on the internet" (Monostori, 2014:9).

2 It should be noted that this chapter is only interested in the types of communities which are constituted to create innovation outside of the boundaries of the focal company and its innovation related outcomes.

3 Innovators are the people who suggest new perspectives in content creation in online communities.

4 Educators are the people who share the knowledge they have with the community and they are the main actors in content co-creation in online communities.

5 Challengers are the people who question the provided information or sometimes flavor the discussions through posting opposing views or data that keep the threads active. This maintains the content co-creation process, so the challengers also add value through increasing content quality by eliminating any kind of bias by keeping the community democratic and preventing any kind of group domination in addition to stimulating the creative culture of the community.

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Chapter 5
"New Normal" Strategic Communication

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ABSTRACT

The digital industrial revolution, also called Industry 4.0, is substantially changing all areas of business. The application of modern technologies is transforming not only products and processes in the industry, but also business models in all sectors, which further implies required adaptations of all business functions. This chapter addresses the new dynamics and implications for strategic communication brought on by digitalization. A planning process of strategic communication will be elaborated within a digital context, together with the specifics of communicating with younger generations. Communication activities mostly relevant for companies in the new industry will also be presented. The issue of ethics in strategic communication will be also addressed, together with major initiatives in regulating the standards of the profession. The purpose of this chapter is to describe the changes that new technologies have brought to the discipline.

INTRODUCTION

Companies today operate in an extremely complex, turbulent, and technology-driven environment, which requires better understanding of changes and adaptations. For many industries, it is particularly digital transformation that dictates major adaptations in the domains of strategy, structure, product development, and service delivery (Zerfass et al., 2018a). Digital transformation integrates advanced digital technologies, such as Internet of Things (IoT), Artificial Intelligence (AI), big data, cloud platforms, Virtual Reality (VR), Augmented Reality (AR), and others in all domains of business, creating tremendous changes in the way companies work and manage their relationships with stakeholders.

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Both academics' and practitioners' interest in examining the fourth industrial revolution, known as Industry 4.0, has been growing rapidly ever since the emergence of the term at the Hannover Fair in 2011 (Sung, 2018). According to Lee et al. (2013), it represents the next phase of digitization of the manufacturing sector, in terms of the implementation of advanced digital technologies, creating smart factories, and the new and changed way value is designed, created, and delivered. It focuses on increasingly individualized customer requirements (Vaidya et al., 2018). The authors report that the essential components of Industry 4.0 include: big data and analytics, autonomous robots, simulation, horizontal and vertical system integration, Industrial Internet of Things (IoT), cyber security and cyber physical systems (CPS), the Cloud, additive manufacturing, and augmented reality. Hence, Industry 4.0 is still a constituent of a socio-economic environment and the success of this transformation depends not only on its technical feasibility, but also on its social perspective (Kovacs, 2018).

"New Normal" is a term used to define the new form which occurred as a result of both globalization and the development of technology (Ucatürk et al., 2012). Companies are doing business in an environment that is more mobile, more competitive, and much faster than environments in the past. Technological improvement and the tech revolution, the rise and emergence of new economies in the world, excessive competition, environmental issues, and the increasing power of consumers have become the main characteristics of the new economy. In this context, communication strategies have to change dramatically and adapt to the technical requirements and opportunities that the new industry brings to the "new normal".

According to the European Commission report (2016), progress and advances in digital technologies, such as IoT, Cloud computing, 5G, analytics and business intelligence, as well as robotics, are transforming not only products and processes in the industry, but also business models in all sectors. Telukdarie et al. (2018) explain that technology development, including Industry 4.0 and IoT, together with vertical, horizontal, and total business integration, demands digital enablement and total business optimization for securing business sustainability. The authors argue that total business optimization must include all business functions, from production, supply chain, over sales, distribution, maintenance to human resources, finances, information management, and others. This presents the conclusion that all business functions need to be changed and adapted, including strategic communication. This chapter will focus on strategic communication within a new environment, aiming to describe the changes that new technologies have brought to the discipline, as well as the communication practices that can contribute to business success in the new economy and new industry.

THE FUNDAMENTALS OF STRATEGIC COMMUNICATION

Both scholars and practitioners report that every organization needs a management function that initiates, directs, and guides its communication with all groups from the internal and external environment (Van Ruler & de Lange, 2003). The theory of stakeholders (Freeman, 1984) explains them as individuals or groups that directly affect or are affected by the company's operations, whether they provide resources (buyers, investors, employees), form the structure of the industry (suppliers, strategic alliances), form the social and political arena in which the company operates (communities, governments), or they are mediators between the company and other stakeholders (media). For the purpose of more easily understanding stakeholders and creating effective communication programs with them, the most common way

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of grouping them is into 'internal' and 'external' (Table 1), with their number and relevance depending on the company's core business and organization.

Stakeholder mapping is a management tool used for the planning of communication activities based on stakeholders' priority for the company/program, determined by the relevance and influence they have on the business, or the level of interest and power they have (Cicvarić Kostić, 2011). Identifying and mapping the stakeholders allows them to be classified, monitored, and managed according to their priority (de Oliviera & Rabechini, 2019).

All communication activities have to be implemented to help achieve a company's goals. This makes communication management a strategic management activity (Van Ruler & de Lange, 2003). Argenti et al. (2005) emphasize the increasing need for an integrated, strategic, long-term approach to communication. The authors explain that each communication function fulfills specific objectives, is targeted at specific stakeholders, and is delivered through the most appropriate channels for those stakeholders. All of these elements have to be consistent both with one another and business strategy and goals.

Since the first issue of the International Journal of Strategic Communication in 2007, scholars have been exploring the field of strategic communication (Heide et al., 2018; Van Ruler, 2018; Zerfass et al., 2018c; Hallahan et al., 2007). Hallahan et al. (2007) introduced an often-cited definition of strategic communication, explaining it as the purposeful use of communication by an organization (or cause, or social movement) to fulfill its mission. As an umbrella term, strategic communication is an agile management process (Van Ruler, 2018) and refers to all types of goal-oriented communication initiated by a company (management, marketing, public relations, technical communication, political communication, and information/social marketing campaigns) to address any group of stakeholders (Zerfass et al., 2018c). It integrates all those communication activities that are associated with a company's goals and strategies (Van Ruler, 2018).

Strategic communication commonly serves as a proper substitute for the term 'public relations', which has been discredited in the 21st century and is usually poorly translated into other languages (Zerfass at al., 2018c). At a conceptual level, according to these authors, the latter is mainly devoted to audience behavior and the relationships between a company and its stakeholders. Thus, public relations deals with the external and internal communication activities of companies, excluding marketing communication.

Even though strategic communication as a term is used in many fields and by any type of organization, an empirical study from 2011 showed that the business sector prefers the term 'corporate com-

Table 1. Stakeholders of a company

Internal Stakeholders	External Stakeholders
• Employees • Management • Shareholders • Administrative staff • Trade unions • Trainees/volunteers • …	• Customers • Organizations in the company's value chain creation • Other companies in the industry • Media • Opinion leaders / influential persons • General public • Agencies and other state institutions responsible for the industry • Local self-government • National and international professional associations / chambers • International organizations and NGOs dealing with industry issues • Educational institutions

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munication' as an alternative for public relations (Zerfass et al., 2011). Originally, the term 'corporate communication' was to differentiate between a company's communication with its environment and communication about its products or services (Argenti et al., 2005). Van Ruler & de Lange (2003) state that van Riel explains corporate communication as the different forms of organizational communication, traditionally separated into marketing communication, external communication/public relations, and internal communication. After a thorough analysis of leading authors' publications, they concluded that communication activities should be centralized and coordinated at the top level of a company, which results in the need for a strategic approach to communication.

To conclude, strategic communication is a multidimensional concept that integrates closely related communication disciplines, such as advertising, business communication, corporate communication, marketing, organizational communication, and public relations (Heide et al., 2018, Hallahan et al., 2007).

Generation Y and Z: Insights for Successful Communication

Understanding the needs, expectations and interests of stakeholders is crucial for developing an effective communication strategy, but special attention should be paid to the difficulties encountered in communicating with generations Y and Z. Generally, a generation gathers people of a similar age who share a common position within the social development process, it is a product of the time in which these individuals live, and the technologies, media, and social conditions and events which have shaped them in a unique way (Van den Bergh & Behrer, 2011). When it comes to younger generations, companies often fail at understanding their expectations, preferences, and needs regarding communication, which is a result of rapid technological development. The major change to communicating with younger generations is the shift of the communication arena itself to internet and social media. In addition to adapting communication to these platforms, companies should also understand the specifics of generations Y and Z (Table 2), whether they are customers of the company, current/future employees, or representatives of other stakeholder groups.

Keeping in mind the characteristics of GenY and GenZ that are explained above as well as recent research (upfrontanalytics.com), almost 60% of millennials care about the social responsibility of businesses and want to change the world. This implies the relevance of corporate social responsibility (CSR) as a business philosophy that explains companies have to contribute to not only the economy, but also to the environment and society as a whole (Vlastelica et al., 2018).

Framework for Strategic Communication Planning

Communication in the new business platform can be viewed in the long-term as a program and a management function, or in the short-term as a campaign. In both cases, the planning process involves several phases, elaborated below. During the whole process, attention should be paid to Industry 4.0 requirements and all the impending changes which will affect production necessities, customers, and employees should be explored.

Research and Situation Analysis (Data Management): Within the initial phase, public opinion about the company and/or some specific issue is examined. Furthermore, factors of the internal and external environments are analyzed, as well as the general business climate and market insights, media, as well as shifts and trends relevant to the company/communication program. Firstly, research and analysis reveal the issues and challenges that should be addressed. Issues refer to anything that goes wrong or could be

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Table 2. The specifics of generations Y and Z relevant for communication

Generation Y GenY, millennials, internet generation, dot. com generation	• Born in the period from 1980 to 1994 (Chung at al., 2009) • Experienced both economic expansion and crisis; fully computer literate, have grown up with modern technology, computers, smart phones, and the internet; open to change, and to a large extent express self-esteem and optimism, as well as liberal attitudes and self-expression inclination (Pew Research Center, 2010) • Characterized by a materialistic and consumer culture, which is primarily the result of technological innovations (Hanzaee & Aghasibeig, 2010) • Show a very mature financial and purchasing commitment, although it is also worth remembering that millennials, even if they have money to spend, are looking for value for their purchases (Goldgehn, 2004) • Do not use digital media only for entertainment (for example, online games, playing music on the internet, watching movies and TV programs), but also for activities that are not possible through traditional media: access to and exchange of information, socializing and conversation with friends, online product shopping, posting comments and videos on interesting topics (Tanyel et al, 2013) • Regarding business and companies' behavior, they have similar positive attitudes towards socially responsible companies, buy its products and pay attention to the message that these companies send (Valentine & Powers, 2013) • Regarding work environment, the main commonly preferred factors for job selection include having power and authority, a friendly and causal work environment, and opportunity for career and salary advancement, among others (Wong et al., 2017)
Generation Z	• Born after 1995; have been growing up in conditions of global crisis, familiar with technology, with interaction on social networks their primary form of socializing (Bassiouni & Hackley, 2014) • Have been using the internet since childhood • Want easy-to-use technology that will solve their problems, help coordinate their activities, or provide them with relevant information, whether via Google, Youtube (Rothman, 2016) • Obsessed with their appearance and the way others see them, concerned about appearance on two levels – their appearance on the internet and about their physical appearance; carefully create their personal brand to reflect how they want others to see them; know what content to publish and when in order to evoke maximum engagement from those to whom they are connected through these platforms (Fromm, 2017) • Lack the critical thinking skills necessary for making informed choices; they prefer watching a video instead of reading an article, as well as writing an instant message on the phone/social network rather than sending an e-mail (Rothman, 2016) • Often publish content and check their social networking tasks many times a day (Perlstein, 2017) • Have been taught that change and diversity are a way of life; they are not limited to geographic space or time zones when it comes to work; they want to change the world, to be socially responsible and to know that their contribution is very important (Rothman, 2016) • Due to information overload, they quickly receive information, but also quickly lose interest in it. As The New York Times reported, in an era of emojis and six-second video clips, companies will not reach these young people if they do not adapt to the situation and begin communicating with them through large photos and a couple of key words (https://www.nytimes.com/2015/09/20/fashion/move-over-millennials-here-comes-generation-z.html)

better and comprise both business issues (such as market share, a new competitor in the market, sales results, public sector relations, reputation risks, and others) and communication issues (such as public awareness, public opinion, media coverage, and others). A particularly important part of this phase is the identification and analysis of primary key audiences, their age, gender, location, habits, attitudes, and opinions on the company/topic, together with their specific needs for information, as well as the media they consume.

Within the analytical phase, digital technologies can provide support for information gathering and analysis.

A digital environment enables real time and easy access to data. There are a myriad of different tools and softwares providing web listening, from those that follow and listen to keywords and relevant channels, over those that can assign sentiment to mentions or track social media user groups such as influencers, to those that create automatic reports or custom dashboards metrics, insights, engagement summary, etc. (https://www.iab.com/guidelines/iab-measurement-guidelines).

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Setting Both Strategic and Operational Communication Goals: Strategic communication goals determine a basic orientation for a longer period (for example, better understanding of the community and building the image of a company that delivers top-level services), while the specific objectives relate to particular situations, key audiences, programs or actions (for example – to increase the female population's level of knowledge on the importance of preventive breast exams). Communication goals have to be in line with the business goals and should be defined according to SMART principles. Well-formulated goals are also the basis for measuring the effects of the strategy. If the defined goal has a quantitative component, then it is easier to evaluate its achievement. Strategic and operational goals must distinguish what can be the implications of the new industry and new economy in relation to all stakeholders.

Strategy Development: The strategy supports the way in which the set goals will be achieved. It defines the framework of programs and specific communication tactics. For the purpose of achieving the synergistic effect of communication, programs and tactics must be harmonized and coordinated. The communication strategy also defines the necessary resources for the implementation of activities, the budget, and an activity timetable. The strategy should include business operations, and maximize the effect for strategic outcome, using all resources available from Industry 4.0.

Realization of Strategy and Programs: At this stage, it is necessary to monitor the activities and implementation of the communication programs and tactics through communication channels, using the right communication tools and techniques. Communication channels are the means used to carry a message in order to enable communication (Wilcox et al., 2015). The authors explicate that channels can be verbal or nonverbal, remote or in person, mass or interpersonal, asynchronous or synchronous. Furthermore, communication channels include face-to-face communication, media, mobile channels, electronic communication, and written communication. In every channel, different tools or a combination of tools are used. For example, for employee communication, tools such as intranet/extranet news and information, meetings (one-on-one or townhall meetings), mobile messaging, newsletter (print or e-magazine), social media messaging, or video messaging can be used. Whereas channels and tools are very much dependent on the technology available, and overall Industry 4.0 requirements, techniques are very personal and depend mainly on the individual's capacity for effective communication.

Evaluation and Measurement: Since there is no unique method or indicator for measuring the success of communication programs, McNamara (2011) deemed this phase the 'Achilles' heel' of the profession. In general, the authors point out that measurement and evaluation must be done in several phases, and at each stage different methods and indicators can be used. The first phase of the evaluation involves a quantitative and qualitative assessment of the work of a communication person/department or consultancy. The second phase involves monitoring short-term results, such as direct effects of communication activities (media clipping). In the third phase, the fulfillment of defined goals is assessed. The International Association for the Measurement and Evaluation of Communication - AMEC - proposed a framework for effective communication measurement, the Barcelona Declaration of Measurement Principles (https://amecorg.com). Measuring principles were adopted in 2010 by relevant professional associations and are defined as follows: 1. Setting goals and measuring are the basics of communication and public relations, 2. It is recommended to measure the outcome of communication, and not only short-term results, 3. The effect of communication on business performance can and should be measured whenever possible. 4. Measurement and evaluation require the use of qualitative and quantitative methods, 5. Advertising Value Equivalent Equivalence is not a measure of PR/communication value, 6. Social media can and should be measured consistently with other media, 7. Measurement and evalua-

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tion should be transparent, consistent, and valid. In 2015, an international working group reviewed the original Barcelona Principles and launched the upgraded version.

The digitalization of communication strategies and programs has brought new measures and made the quantification of results easier to perform (https://www.iab.com/guidelines/iab-measurement-guidelines). For instance, awareness as a goal can be measured in digital media by indicators - reach, CPM, viewability. Engagement in a campaign can be measured by cost per engagement, or dwell time (how long people are likely to spend looking at content, or buying goods), or dwell rate (the percentage of users exposed to given content who interact with that content moving their cursors over it). Site traffic can be measured by cost per click, or site visit quality, and cost per action can be used as a conversions indicator (https://www.iab.com/guidelines/iab-measurement-guidelines).

STRATEGIC COMMUNICATION ACTIVITIES: SHIFTS IN NEW ENVIRONMENT

This chapter will focus on the main activities relevant for strategic communication in a new environment. After analyzing well-known trade publications and research firms, O'Connor and Shumate (2018) found that one of the major trends in strategic communication is digital evolution. Accordingly, digital communication will be elaborated in this section. As crisis management should be integrated into the strategic management approach (Jaques, 2007) on one side, and digital platforms become strategically important, particularly in the case of crisis (Ki & Nekmat, 2014), on the other side, we recognized crisis communication as a concern that should be addressed in this chapter.

Challenges of Digital Communication

Digital technologies have not only led to a new industrial revolution, but also have substantial consequences for the way we live, work, and communicate, both within a private and business environment. The internet, particularly the second generation of web services that allow two-way, real-time communication and user generated content, along with mobile connectivity, have significant impact on communication and the relationships between people, and between companies/brands and people. According to the Global Digital Report 2018, issued by global marketing agency We Are Social, and media management platform Hootsuite (https://wearesocial.com/blog/2018/01/global-digital-report-2018), 52% of the global population are internet users, 42% of people use social media, and 68% are mobile phone users, with a large percentage of time per day spent on the internet. In addition, the European Communication Monitor 2018, one of the largest research studies among communication professionals in 48 countries, reports that the three most important strategic issues for communication management until 2021 include coping with the digital evolution and the social web (Zerfass et al., 2018b). Keeping in mind the relevance of digital tools for communication management, the Interactive Advertising Bureau (https://www.iab.com) identifies the major trends in digital communication: the rise of content marketing and earned media, mobile consumers and mobile marketing, social media revolution, and data driven marketing.

The first trend incorporates a new media outlet, which here refers to digital channels. In addition to traditional media, digital media could be also analyzed through three categories, paid media – content and channels that the company pays for, owned media – content that the company creates on communication channels controlled by the company and earned media – content relating to the company/brand that someone else has created (Figure 1).

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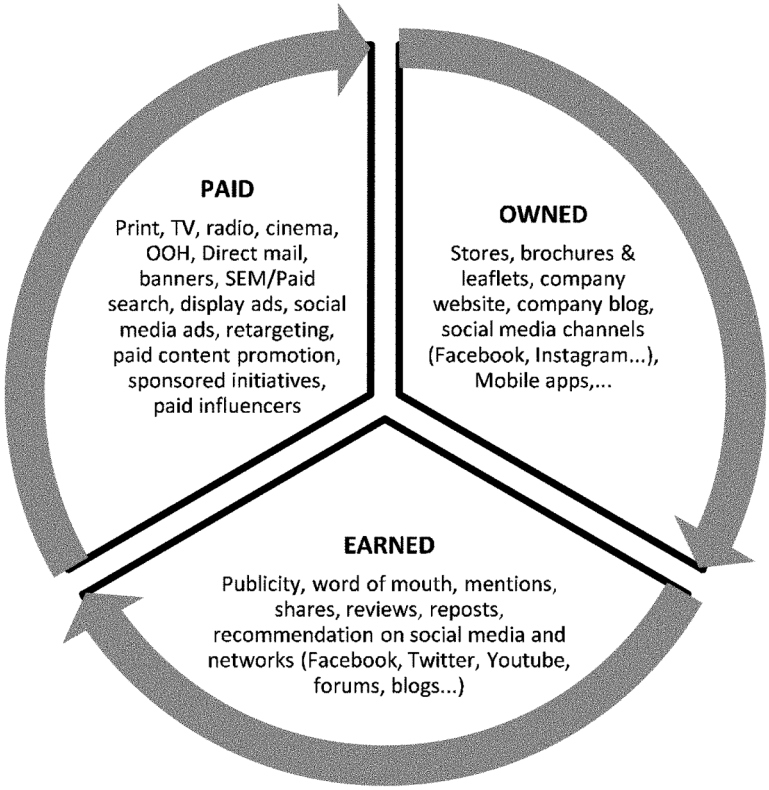
Figure 1. Paid, owned, and earned media



Dietrich (https://spinsucks.com/communication/pr-pros-must-embrace-the-peso-model) expanded this model (to the PESO model) by introducing one more type of media – shared media. The PESO model distinguishes social media as a separate category that companies have begun to use for both internal and external communication, while owned media refers only to the company's website or blog.

As the internet is most commonly accessed via mobile phone (according to the Global Digital Report 2018, 52% of web traffic by device highly favors mobile), this presents the conclusion that every form of digital communication (website, social media) must also be adapted for display on a mobile phone.

Website: User Experience Optimization

The large body of extant knowledge has already emphasized the importance of digital communication activities and channels, and the opportunities they create for businesses (Veselinović et al., 2016). The basic channel of digital communication is the company website, which is also part of the company's visual identity. For this reason, it should be designed to look attractive, be user friendly, and provide all the relevant information that each stakeholder expects. Generally, the basic criteria that should be met in creating a digital communication strategy (Waters et al, 2009) include:

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- Transparency – refers to a detailed overview of the company, its activities and history, ownership, key people, important business documents that ensure the transparency of work (such as organizational structure, financial reports), contacts, photos, etc.
- Usefulness – refers to providing information that is relevant to stakeholders (meaning the set of information that each of them expects and considers relevant).
- Interactivity – refers to stimulating engagement and relationships.

To be effective and efficient, a company website should have an appropriate information architecture (grouping of content, labeling) and be designed to provide an optimal user experience (Figure 2). One of the frameworks for optimizing user experience is defined by Mohhamed et al. (Kostić-Stanković et al., 2017). It consists of 7Cs:

- Context – aesthetic (layout, design, font, colors, sounds) and functional features (easy to use, quick load, easy to navigate). Generally, websites can be more function-oriented, such as large retailers' websites (https://www.amazon.com, https://www.ebay.com, https://www.aliexpress.com) or more aesthetic-oriented, such as cosmetics companies' websites (https://www.lancome.com, https://www.cartier.com).
- Content – the website should provide relevant, interesting, useful, well-organized, and up-to-date information for site visitors, and include multimedia forms of information, such as text, graphics, video, and audio. As the website is the one with the informative role, profiles and pages of company social networks should not insist on including informative content, but more on offers promotion, communication with users in order to strengthen the image of company/brand.
- Communication – this is a feature that relates to the ability of the website to provide one-way communication with visitors (e-mail), or real-time communication (chatbots – programs that automatically engage with received messages, implies the use of AI).
- Connection – the website should contain links to social media and other related and relevant websites.
- Commerce – possibility for buying the product on the website.
- Community – websites can provide communication between users by creating virtual communities within the website.
- Customization – this is a feature that relates to the ability of the website to be modified by visitors and personalized (https://my.ebay.com).

The last two Cs are usually included in the websites of strong, well-established brands with tradition.

Social Media: Strategy and Content

Since social media and social networking sites allow participants to express their views and opinions, as well as to exchange knowledge about the most diverse of topics, they represent an extremely powerful channel of communication. The rise of social network use has led to changes in the way brands and companies communicate with consumers and other stakeholders (Veselinović et al., 2016). However, not all social networks are relevant and useful for companies. Therefore, it is necessary to define social media strategy, plan content, and regularly coordinate communication on social media.

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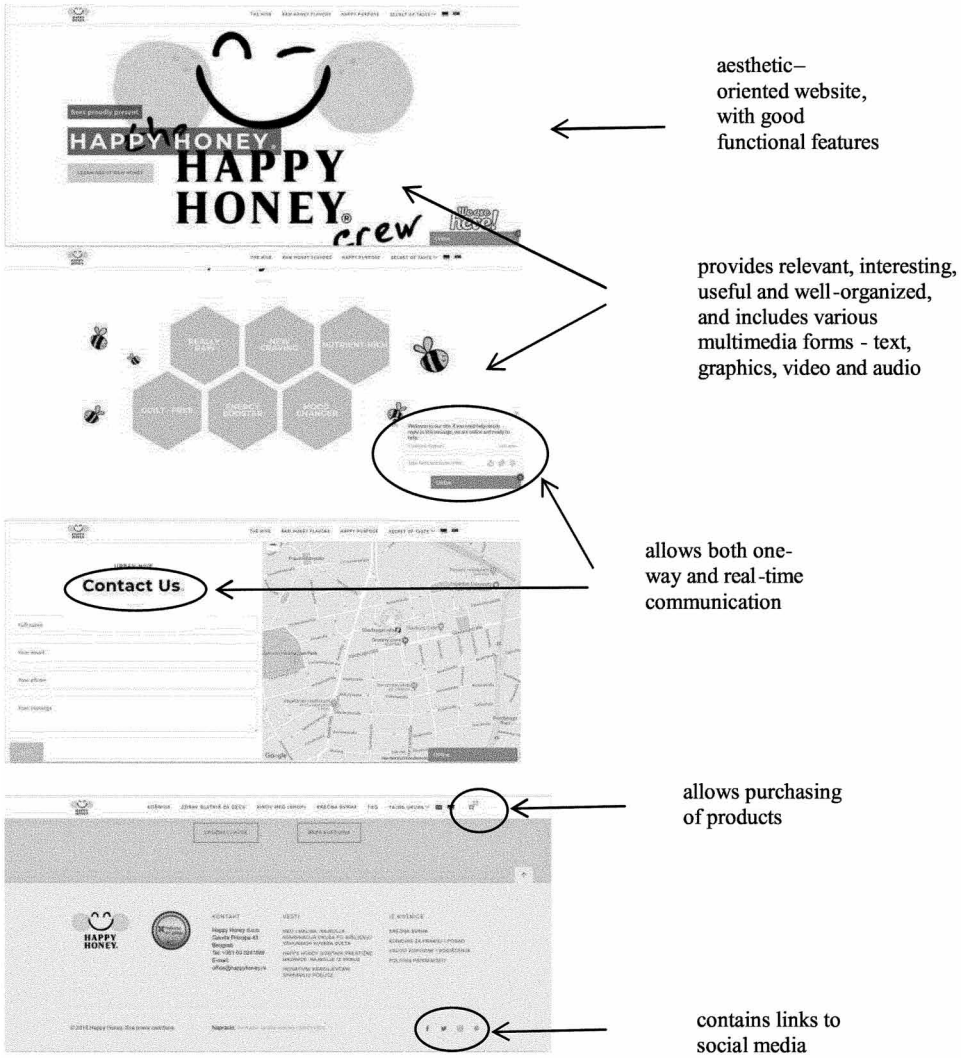
Figure 2. Screenshots of several pages of Happy Honey internet presentation (https://happyhoney.rs), that illustrates optimized user experience (used with permission)



Based on the communication strategy planning framework presented in the previous section, a digital media strategy also begins with *research, situation analysis and understanding market insights*. As has already been mentioned, different tools and softwares providing web listening are available on the market, and the result of this initial phase is *the understanding of (the) target audience/s* we want to address. One of the most prominent features of social media is precise targeting, using geo-targeting (region, country), demographic characteristics (age, gender), behavior (interests, preferences and behaviors, keyword they are searching for, devices they use), or targeting an audience that has already been interacting with the brand, or lookalike expansions – targeting a new audience with interests similar to an already existing audience. The large amount of data about people that companies can today access draws attention to several important ethical issues that communication professionals have to address. The issues refer to security and data protection or tracking target audiences and collecting information

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through software to gain important intelligence as a basis for strategic management of communication activities (Valentini, 2018).

Following step in digital communication strategy is *setting goals,* which could be anything from raising brand awareness, to engagement of target audiences and their conversion. Depending on the goal, as well as all data and insights collected during the research phase, the next phase comprises planning content and choice of communication channels.

Special emphasis has to be put on the strategy of creating and distributing relevant and consistent *content* in order to attract and retain the attention of target audiences, through blogs, images, video content, stories (images or videos that can be seen only 24h), storytelling, and others. Research results obtained by the Content Marketing Institute in 2017 support the relevance of content in the digital communication arena. Results show that content marketing campaigns generate three times more users and potential consumers than direct contact, and costs are lower by more than 60%; almost half of people between 18 and 49 years of age are looking for information and news online; small companies that have a blog generate more than 120% more users than companies that do not, as almost 80% of internet users read blogs, etc.

Digital content may have the purpose of introducing an offer to a larger number of social network users or initiating a purchase. Based on these two goals, Chaffey and Ellis-Chadwick (2012) define types of content with regard to their purpose, or what they aim to do:

- To entertain (e.g. games, quizzes, competitions and others) – this type of content should encourage users' good mood and is usually humor based. It should be appropriate to the company/brand image and does not even necessarily have to offer information about the offer.
- To educate (e.g. guides, infographics, reports) – involves content that will provide knowledge in specific areas or in relation to a particular topic. Content that should educate should be of interest to the target audience, but also in a certain relation with the offer.
- To inspire (e.g. reviews, testimonials, endorsements) – refers to content that directly addresses customers through emotions and aims to provoke the purchase of a product or service.
- To convince (e.g. ratings, features, calculations) – content that relates directly to the offer and should comprise call to action. Unlike content that should inspire, this content should be based less on emotions, and more on facts.

Regarding *communication channels,* results in the Global Digital Report 2018 show a 13% global increase in social media usage since January 2017, with Facebook still having the most daily active users compared to other social networks. Thus, it remains the main audience channel. The Report also comprises the latest insights from the comScore panel, and compares the popularity of social networks by share of time in a large number of countries. Despite the fact that the popularity of social networks depends on the country/region and the habits of that particular population, the four major social networking applications are generally Facebook, Instagram, Snapchat, and Twitter. When it comes to the popularity of social media in general, firstly ranked are Facebook and YouTube, with WhatsApp and Messenger not far behind. Keeping in mind the traits and habits of younger generations that were discussed above, YouTube, Snapchat, and Instagram are the most popular online platforms among them (https://wearesocial.com/blog/2018/01/global-digital-report-2018). This clearly indicates what channels should be used in digital communication strategy depending on the age of the target audience. All of these social media and networks have their own characteristics and formats, and guidelines for creating campaigns.

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In addition to this, one more trend in communication with consumers, especially the younger population, has been identified by Forbes – *influencer* marketing. Social media influencers are third party endorsers who shape audience attitudes through social media (Gorry & Westbrook, 2009), and have the ability to affect the attitudes and behavior of others (Liu et al., 2015).

In most cases, influencers could be segmented using two typologies, 4Cs and 3Rs. According to the online marketing company SEO.com, the 4Cs include context, consistency, connection, and content, while 3Rs include the following criteria – reach, relevance, and resonance (Solis & Webber, 2012). Keeping in mind the latter, Traackr, a leading influencer management platform, suggests several types of influencers: celebrity, authority, connector, personal brand, analyst, activist, expert, insider, agitator, journalist. Solis and Webber (2012) argue that the choice of influencers in a campaign needs to be in line with campaign objectives. For example, if the goal is to establish thought leadership, the campaign should engage individuals who possess authority or trustworthiness, while if the goal is to raise brand awareness then the campaign should engage individuals who are popular (Cicvarić Kostić et al, 2018).

Planning *the budget* is also an important step in strategy development, and due to the possibility of very precise monitoring of the strategy/campaign performance, it could be optimized through the process of implementation. A great advantage of digital communication strategies and programs is the fact that they are more effective and efficient that traditional types, as they use various *performance indicators* (as has been mentioned in the previous section). These indicators show if the target audience notices or reacts to the content (likes, comments, shares) and how they generally behave in relation to the content. They can be *monitored* on a real time basis, thus allowing for optimization and redefining of the strategy during implementation, in order to have a greater impact on the target audience.

Challenges of Crisis Communication

Communication plays a key role in crisis management (Millner et al, 2011). Within a strategic context, communication has to address both issue and crisis management, due to their potential impact on a company's ability to reach its goals. During the simultaneous development of issue and crisis management, both scholars and practitioners have been paying attention to the explanation of two related disciplines (Jaques, 2010, 2007; Ašanin Gole, 2005; Heath, 2002). An issue refers to a trend or an event, either inside or outside of the company, which can significantly affect the ability of the company to meet its goals (Ansoff, 1980). A crisis situation implies an event that may have a negative influence on the performance, image, and reputation of the company and/or the stakeholders (Coombs, 2007).

Keeping the distinction between these two terms in mind, Jaques (2007) reported that the purpose of issue management is to identify potential trends and events which may have an impact on the company. Concurrently, crisis management is a holistic, integrated process ranging from crisis prevention and crisis preparedness, to crisis response and crisis recovery. Taking into consideration the explanation of the disciplines, it can be concluded that both issue and crisis management are important topics on the strategic communication agenda.

How to Manage Crisis Communication?

Jaques (2007) posited the issue and crisis management relational model, where the author elaborated that the best way to manage crises is to understand and manage issues. Thus, the author positioned issue management in both crisis prevention and post-crisis management. The model includes four elements

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with the activities and processes they comprise (Jaques, 2007). The elements are elaborated below, particularly in terms of communication activities that should be implemented.

Crisis Preparedness: It includes planning, assigning roles and responsibilities, defining manuals, conducting trainings and simulations. The crisis communication plan determines people in the company to be involved in crisis management, defines the procedures and decision-making process, as well as the communication framework for reporting and communication with internal and external stakeholders.

Crisis Prevention: This phase covers myriad activities, such as environmental scanning, social forecasting, issue and risk management, determining infrastructure, documentation, training for an emergency response. It is necessary to continuously analyze the environment, both internally and externally, and to anticipate possible risks and crisis situations (such as poor maintenance practice, human error, bad planning, leadership failure, material failure, unethical or dishonest behavior, and others).

During the pre-crisis phase, a notification and monitoring system should be put in place, to regularly monitor social media and traditional media, as well as evaluate key words and relevant topics. It is essential to establish notification systems which allow for rapidly reaching stakeholders through multiple channels.

Crisis Incident Management: This phase includes systems activation/response, strategy selection and implementation, damage mitigation, stakeholder management, media response. It is essential to be prepared before the crisis occurs. There are many examples of reputations endangered or damaged during a crisis situation because of an inadequate communication strategy (Shell, Volkswagen, FIFA and others). In the absence of a proper crisis communication strategy, stakeholders do not know what is happening and can quickly become confused and react in a negative way. Any business is likely to face a crisis situation of some type at some point, and the way the company responds can either damage its reputation or eventually boost its image. Having in mind how news goes viral quickly, the response has to be instant, efficient, using all available media.

When a crisis occurs, a company has to address the public immediately after the crisis arises. Information must be accurate and anyone who sends a message from the company must comply with other sources and other messages. The initial response to the crisis also involves informing employees about what has happened, as every employee is a potential communication representative for the company.

The response to the crisis involves the preparation of basic information on the crisis situation (what happened), as well as short-term and long-term measures to be taken. The crisis team usually defines the primary target audiences for the specific situation, the key messages for each of them, as well as communication activities to be undertaken. In case of a crisis, a company can open a page on the website which will provide information on the crisis. Some research reveals that this is an important and effective channel of communication (Taylor & Kent, 2007).

Depending on the type and depth of the crisis, as well as the degree of reputation risk, the management team determines the response to the crisis situation (Seeger et al., 2003). The response has to be planned and coordinated. As crises endanger company reputation, Coombs and Holladay (2002) initially tested the situational crisis communication theory (SCCT) to help managers protect reputational asset. SCCT models the crisis process and proposes a system for matching response strategies to the crisis type. The authors explained the eight crisis response strategies, ranging from defensive – putting the company's interests first, to accommodative – putting the victim's concerns first (an attack on the accuser, denial, excuse, victimization, justification, ingratiation, corrective action, and full apology). This approach incorporates previous research that suggests clustering of the crises, as similar crises can be managed in similar ways (Mitroff, 1988).

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Researches also confirm that a proactive approach to resolution is a good strategic framework for successfully addressing the crisis situation and positively influences the attitude of stakeholders (McDonald et al, 2010). According to the Forbes Agency Council (https://www.forbes.com/), this approach includes the golden rules of crisis communication: the company should take responsibility and communicate clearly, it should express regret, apologize, offer a solution, and perform the necessary changes, and finally, it should constantly monitor, plan, and communicate. The pressure for immediate communication in a crisis comes from social media. Whether a company is active on social media or not when a crisis occurs, people will definitely talk about it.

Post-Crisis Management: The final phase includes recovery, business resumption, post-crisis issue impacts, reputational damage, evaluation, and modification. According to the Institute for Public Relations (https://instituteforpr.org), after the crisis, the company returns to business as usual. Although the crisis is no longer in focus, additional communication activities must be carried out in order to manage the reputation of the company (damage control). Furthermore, it is necessary to inform both internal and external stakeholders about the process of recovering the company from a crisis, as well as the corrective actions undertaken and results. In this way, a company finalizes the story of a crisis situation. Every crisis should be a new lesson learned for the company and the crisis management team. Therefore, it is important to evaluate how the crisis was managed, and to include the results in the manual for crisis communication in order to improve the planning and crisis management process.

Crisis Communication in the Digital Age

Strategic communication, like many other industries, is going through a digital transformation that will change the discipline substantially in the next few years. Ki and Nekmat (2014) report that web 2.0 technologies and social media serve as vital platforms for instant and direct responses and the dissemination of information globally. Today it is all about personalized and real-time communication. In the case of crisis communication, this brings new challenges and opportunities for communication specialists. Companies can target diverse audiences with content that is tailored to what they want.

Ki and Nekmat (2014) conducted a study that examined the Facebook usage of Fortune 500 companies and the effectiveness of the platform for crisis management. They reported that the most often-used crisis response strategies were justification and a full apology. Furthermore, they emphasize the relevance of interactivity in crisis communication, as they found a significant relationship between a company's crisis communication efforts via social media and the overall positivity of tone in reactions.

As social media monitoring becomes an integral part of scanning for many crisis risks, some may indeed emerge online, but they may not necessarily require action from the company (Coombs & Holladay, 2012). The authors defined these crisis risks as a 'paracrisis', and they refer to the threats that charge a company with irresponsible or unethical behavior, but still require additional study. Basic strategic concerns for evaluation of a crises threat include decisions about whether and how to address the paracrisis. The authors explicate three communicative response strategies for a paracrisis (Coombs & Holladay, 2012):

- Refute – defending the company against stakeholder claims that it is acting irresponsibly.
- Reform – changing the company's practices to reflect the demands of the stakeholders.
- Refuse – not acknowledging the challenge and not responding to it.

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The authors also provided three basic pieces of social media tactical advice for paracrisis communication – be present in social media, respond via the media channel where the paracrisis emerged, and use multiple communication channels to deal with the paracrisis, including both social and traditional media outlets.

Preparing for crisis communication scenarios of the future will be a challenging task, shaped by different technologies such as AI, machine learning, analytics, cloud, mixed reality (a combination of AR/VR), and others. With video exploding, and live streaming happening on every social media platform, communication professionals have to also monitor new popular technologies. The majority of the content that people consume online is already video, and this medium will become even more dominant in the future. In addition, the rise of instant messaging is expected to be huge (Chatterjee, 2018).

An urgent matter that can seriously jeopardize the reputation of a company is fake news. The digital age and the rapid expansion of social media have provided a fertile ground for dissemination of fake news and misleading information. Aldwairi and Alwahedi (2018) define fake news as fictitious articles deliberately fabricated to deceive readers. Fake news is published by social media and news outlets usually for the purpose of increasing readership. The main goal of fake news can be defined as profiting from clickbait, rather attracting users with flashy headlines or designs that motivate clicking on links, which then results in increased advertising revenues (Aldwairi & Alwahedi, 2018).

It is very hard to prepare for any fake news scenario. "Deep fakes" are the more alarming avatar of fake news, where AI is used to make anyone say or do anything on video. Many examples with famous politicians or other people being victimized by fake news can be found. Fake news stories are commonly used in politics, and their evident increase could be noticed during the U.S. presidential election, when a number of fake stories supporting the elected candidate's campaign circulated all over Facebook and were read by millions of people (https://www.statista.com/topics/3251/fake-news). According to Silverman et al. (2016), even Facebook engagement through likes, comments, and shares was greater for the top 20 fake news stories than it was for the 20 real news stories in the last three months of the campaign. A research study conducted at MIT about the spread of false news on Twitter revealed that false news was 70% more likely to be retweeted than real news (Norton, 2018). The research showed that generally people, and not bots (automated accounts that impersonate real users), are the reason why false news spreads faster.

In this kind of crisis situation, it is also very important to react fast using the proper communication channels. Jang et al. (2018) identified several pathways for combating fake news, from media literacy education, over enhancing fact-checking procedures available to users, which give warnings that particular stories can be fake news, to detection of fake news sources and filtering out the information from those sources.

COMMUNICATION ETHICS IN A FAST-CHANGING ENVIRONMENT

The regulation of communication implies firstly compliance with the laws and legal acts of the state the company operates in, as well as the inclusion of issues relevant to the communication practice in the legislation. Particularly important for the communication profession in the new economy is the General Data Protection Regulation (GDPR) of the European Union, which came into force in May 2018 as the most important change in data privacy regulation.

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In addition to the legal framework, the most important role in regulation is played by professional associations, which define the standards of knowledge, competences, and behavior for experts in the field, monitor the behavior of individuals and companies, and react properly in the case of unethical behavior. Some of the most relevant professional associations at a global level include:

- International Public Relations Association, IPRA. The association has a consultative role for ECOSOC and UNESCO (https://www.ipra.org).
- International Association of Business Communicators, IABC (https://www.iabc.com).
- European Association of Communication Directors, EACD (https://www.eacd-online.eu).
- European Public Relations Education and Research Association, EUPRERA (http://www.euprera.eu).
- The Chartered Institute of Public Relations, CIPR (https://www.cipr.co.uk).
- The Global Alliance for Public Relations and Communication Management (https://www.globalalliancepr.org).

As communication is a profession that is strongly influenced by local conditions and a network of professional contacts, it is important to have national associations that bring together professionals and promote and regulate the profession within national frameworks.

Communication professionals are responsible for planning communication activities with all groups of the public. As such, they can have a profound impact on individuals and society, which implies the need for a sense of professional responsibility. Major initiatives in regulating the standards of the profession at a global level comprise principles and codes of conduct issued by the relevant professional associations. To illustrate, some of them are presented below.

One of the most important initiatives in regulating the standards of the profession was taken by the International Association of Business Communicators (IABC). The Global standard includes six principles that should be a foundation for anyone who deals professionally with communication – ethics, consistency, context, analysis, strategy, engagement (https://www.iabc.com/global-standard-2).

As the IPRA can be considered one of the most influential associations in terms of tradition, number of members, and international recognition, the codes that are the result of this association's efforts toward regulating the profession are: Code of Venice (adopted in 1961 and in 2009), Code of Athens (adopted in 1965 and amended in 1968 and 2009), Code of Brussels (adopted in 2007 and extended in 2009), and the IPRA Code of Conduct (adopted in 2010). In addition, one of the most important initiatives and regulating standards of the profession was developed by the Global Alliance for Public Relations and Communication Management (adopted in 2003 and updated in 2018).

The ethical issues that communication practitioners may face, but are still expected to overcome include:

- Misleading information and communication.
- Masking obvious problems in a company.
- Using others' intellectual property and plagiarism.
- Publishing images without specifying sources.
- Covered advertising and unlabeled sponsored content.
- Direct or indirect payment for an 'independent' and 'objective' opinion.
- Giving gifts or financial compensation to journalists, in order to generate positive publicity, or presenting a story from just one angle.

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- Ethical issues of public opinion research (privacy of respondents, personal data protection).
- Conflict of interest.
- Creating an illusion of spontaneous individual opinion, when in fact the matter at hand is organized communication activities (in modern practice, this phenomenon is known as "astroturfing").

Undoubtedly, one of the major issues in communication practice in the digital world is post-truth and/or fake news. Concerns have been raised about the use of clickbait and the whole concept of misleading information. However, there has been little effort from content publishers to refrain from doing so, although tech companies such as Google, Facebook, and Twitter have tried to address this issue (Aldwairi & Alwahedi, 2018). Fake news and post-truth are being progressively applied in many areas of communication. As Grech (2017) claims, the term 'post-truth' describes a mostly political setting whereby debate is framed by appeals to emotion and based on half-truths and outright lies, while actual truth is of secondary importance. Post-truth is supported through fake news. Communication ethics have never been challenged like with fake news and post-truth, since Industry 4.0 and the new economy provides fertile ground for their fast expansion. Several pathways for combating fake news have been identified in the previous section. In addition, Jang et al. (2018) say that concerns about the role that bots and cyborgs play in facilitating the spread of false information on digital platforms make the debate on ethics, as well as the need for communication practitioners to reflect and find new ways to preserve truth and ethical standards – even more important.

CONCLUSION

The chapter explained new dynamics and concepts relevant for strategic communication in a changing and technology-driven environment. Thus, it expands the extant body of knowledge and contributes to a better understanding of changes and adaptations in strategic communication, particularly in the fields of its planning, digital communication, and crisis communication. In terms of practical implications, the chapter can serve as a roadmap for advancing a company's communication in Industry 4.0 and also a strategic framework to guide communication activities and priorities in the years ahead. Future research directions should focus on a deeper understanding of each component of Industry 4.0 and required changes and implications they bring to strategic communication.

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KEY TERMS AND DEFINITIONS

Communication Ethics: Recommendations of right and wrong conduct in all aspects and activities of communication.

Content Marketing: An approach directed at creating and distributing valuable and relevant content in order to draw and retain the attention of a target audience.

Crisis Communication: The communication activities that a company plans and performs before, during, and after a crisis situation.

Digital Communication: The activities that transmit messages and information via digital channels.

Generation Y: A group of people born in the period from 1980 to 1994 who experienced both economic expansion and uncertainty and grew up in a high-tech world.

Generation Z: A group of people born after 1995, in a period of widespread internet use and global crisis. They are familiar with technology, and interaction on social networks is the primary form of their socializing.

Influencer Marketing: Third party endorsers who have the ability to affect the attitudes and behavior of others on social media.

Social Media: The interactive platforms of user-generated content that allow the large auditorium to connect, communicate, and create relationships through instant massaging or social networking sites.

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Chapter 6
Digital Marketing Suggestions for Companies

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ABSTRACT

The use of the internet in the business world, changes in communication technologies, digitalization in business processes, and adapting Industry 4.0 require enterprises to keep up with this transformation. Digitalization of enterprises will affect all processes of enterprises from production processes to accounting activities, from financial activities to marketing activities. Businesses that want to step into the digital world in Industry 4.0 should first determine their basic goals and strategies. With the transition to Industry 4.0, the price and promotional activities in manufacturing processes, supply chain, and distribution systems make it inevitable for businesses to adapt their marketing activities to the digital environment and Industry 4.0. This chapter includes strategies that can be used for digital marketing strategies for businesses.

INTRODUCTION

Due to the great transformation that has taken place in the area of communication technologies and with the advent of the internet, it can be stated that both individuals and companies have found themselves in a new world. This world, which can be called as the digital world, has deeply affected the daily lives of individuals and the flow processes of companies.

With digitalization, people able to have the opportunity to interact with one another and also with companies. Also, with digitalization, usage of the internet both daily life and in trade affects all business models and consumer behavior intensely. Nowadays, people do not buy any products or services without searching the internet. Therefore, this clearly shows how important it is for companies to take part in the digital world and create their own platforms in order to reach more people.

To take a look at the revolution in industry and marketing from past to present can give a hint to explain why the internet and technological developments are essential to companies and marketers.

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In the 18th century, industrialization, which started with the participation of machines in production processes and the increase of railways, can be expressed as the first industrial revolution. Moreover, the production capacity of the devices as a result of the change of the energies used in the means of production and thus the beginning of the mass production can be named as the second industrial revolution. Also, the digitalization of production by using automation and computer technologies is defined as the third industrial revolution.

Finally, the industrial revolution, defined by the fact that machines become intelligent and coordinate self-managed production facilities through the internet and inter-machine communication, can be expressed as industry 4.0.

Industry 4.0 will lead to considerable changes in both production processes and future business strategies of companies. With industry 4.0, factors such as cyber-physical systems, the internet of things and the Internet of services will enable companies to step into a new world. Industry 4.0 will provide digitalization of not only a production line or a realized activity, but also will digitalize the whole operation and processes of the company. Moreover, Industry 4.0 is defined as a period in which the interconnected processes are in communication, communicating over the internet, collecting data and completely changing the production process, highlighting the interaction of machines with people. And besides, Industry 4.0 promises a system supported by self-regulating solutions through extensive network communication based on the autonomous production systems and the Internet of objects. Industry 4.0 is a system that directs businesses to integrate with each other and with their customers through the internet and artificial intelligence (Yazıcı, 2010; Toffler, 2008;TOBB, 2016, Gür, 2017).

Considering these characteristics and innovations brought about by industry 4.0, it can be stated that companies that want to adapt themselves to this new system should carry out also a transformation in their marketing activities for effective competition. The reason why companies should adjust their marketing activities to this world can be explained by the evolving of marketing from the past to the present. According to Kotler et al. (2017), marketing has undergone a significant shift since its early days, from being product-driven (Marketing 1.0) to customer-centric marketing (Marketing 2.0) and ultimately, human-centric marketing (Marketing 3.0). And nowadays, it is discussed about marketing 4.0. Marketing 4.0 can be described as the sequel to our widely-recognized concept of Marketing 3.0, which calls for brands to touch the human spirit. Marketing 4.0 is based on intricate observation and analysis of the paradoxes because of the digital technology era. Thus, at this point of view, companies have to realize that digital transformation is essential for them and begin to prepare all the processes for digital transformation. One of the most critical processes in the digital transformation of companies is the adaptation of marketing activities to the digital world.

Digitalization of all processes in the company is important in terms of cost reduction or faster and more efficient work. However, as the marketing activities of these processes are reflected in customers, it is necessary to adapt to digital marketing activities in order to reach the customers who have shifted to the digital environment. This is because, since the developments after Web 2.0, Internet and social media have become a vital resource that provides the flow between consumers, companies, non-profit organizations, intermediaries, and supervisors (Werthner and Klein, 1999; Xiang and Gretzel, 2010).

Through digital transformation in the years to come, mobile technologies, with the speed of the internet, cloud technologies, big data as well as new concepts such as smart tools, internet of things, and industry 4.0. will continue to affect the lives of both companies and consumers. Consequently, it will be impossible for companies that cannot adapt to the digital world to compete with their rivals. Thus, it can be said that companies need to adapt also, their marketing activities to the digital world in order to

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be able to take place in this competition and to achieve sustainable success. In case, Digital marketing activities can be explained by marketing activities performed with new digital marketing tools.

MEETING WITH THE INTERNET

Although the emergence of the Internet has been used for different purposes, including daily life and in the company world, it has however opened the doors of a whole new world for people and companies. The Internet can be referred to as a pull medium because consumers often choose the content they view (Pitta and Fowler, 2005).

The evolution of the Internet to the present day can be seen as Web 1.0, Web 2.0, Web 3.0, and Web 4.0. Each new release actually covers the previous version to improve the missing aspects of the earlier version (Saha and Grover, 2011, p.23). According to Güran (2016), Web 1.0 has a one-way reading-oriented system, and it does not provide the opportunity to comment on reading the content. In this phase, Users are only in a passive position on the Web pages. In Web 2.0, instead of one-sided communication, users have been able to create content (Genç, 2010, p.612). Features that distinguish Web 2.0 from the Web 1.0 can be expressed as sharing, interaction, social media platforms and information sharing sites (Güran, 2016). Web 2.0 has helped users to gain a more free internet environment (West, 2015, p.155). In Web 2.0, users are also allowed to influence the content and have become Web literate (Kurulgan, 2013; Yıldırım and Akıllı, 2017). Therefore, Web 2.0, let users can not only create their own content but also contribute to the content they create and allow them to share these contents with each other.

Web 3.0 refers to the development of people's cooperation with the internet and social media (Abdüsselam et al., 2016, p.265). In other words, Web 3.0 can be defined as a semantic Web. The feature which distinguishes this version from others is that data can be collected and processed. With the use of Web 3.0, it is possible to process all kinds of data and share content. In addition, with the integration of the Internet into smartphones and mobile internet, the concept of using the internet without being connected to any cable has emerged. The Web 3.0 version of the Internet has given rise to mobile internet, mobile applications, mobile sites, and more intelligent and personalized internet access. Big data concept can be defined as another important concept that emerged during the period of Web 3.0 (Güran, 2016).

In addition, thanks to artificial intelligence, the search engines which make predictions about what the users want to do in subsequent searches and mobility which allows users to reach the content they want to reach 24/7 can be listed as the basic features of Web 3.0 (Kurulgan, 2013, p.482). Web 4.0 refers to the last phase of internet technologies and virtualization can be expressed as the most significant innovation that comes with Web 4.0. Augmented Reality technology and cloud technology are important developments of this phase (Yildirim and Akıllı, 2017).

From traditional methods to innovation in the manufacturing and industrial sectors, internet of things, the introduction of three-dimensional printers, the use of artificial intelligence in decision-making processes, and the production processes with big data technologies make the digital transformation of the companies indispensable. Thus, it can be said that digital revolution creates tremendous opportunities for companies (Leeflang et al., 2014, p.2). From this point on, a digitalized company can be defined as a company that can electronically store all data and information electronically, transfer them, send and report them from one place to another using computer networks, and accesses them from anywhere at any time. At the same time, using all the possibilities of the internet and mobile technologies, production, services, trade, collaborations, export, marketing, advertising, and promotion activities in the digital

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era refers to a company operating based on the digital transformation (www.fortuneturkey.com, 2018). According to the situations above, it can be said that with the developing world conditions, innovations in communication technologies and the spread of industry 4.0 in the company world, companies are starting to integrate into this new world.

Before entering the digital world, companies need to be aware of what is needful in order to adapt to the new world. A study, an online survey of 262 digital marketing executives at B2C and B2B companies, shows that "80% of to increase their digital marketing budgets over the next 12 to 18 months" (Maddox, 2015). Companies also should pay attention to the fact that consumers are no longer old consumers. Consumers are now contributing to the production processes of products/services, opening fan pages for the brands they use, expressing their complaints with a tweet, and sharing all their experiences with products/services over the internet. In addition, Consumers have control over their tablets and smartphones while watching television, or while browsing on the internet.

According to research findings, more than 90% of all consumers read online reviews before they buy products, and 67% of all purchasers of consumer goods are based on user-generated content. Also, consumers read at least four reviews before making a purchase (Godes and Silva, 2012). Consequently, having at least one website has become a necessity for companies. In addition, the increase in the use of smart devices and the fact that the internet becomes mobile requires the development of websites suitable for mobile devices.

However, when creating digital company plans, companies should first decide which functions they will carry to the digital world. Companies should first respond to some questions when they meet with the digital world: How will the marketing mix elements be adapted to the digital environment? Will a separate budget be allocated for the digital activities in the financial plans? Which digital platforms will be advertised? Which message will be sent to which consumer group that is targeted? Questions such as how to do personalization if all customers have the same message to be transmitted can be exemplified as the questions that companies must answer first when stepping into the digital world. The fact that companies have a powerful marketing strategy and analyze their customers and competitors well will enable digital marketing strategies to be built on a solid foundation. As a result, companies must analyze their competitors in the digital world, evaluate opportunities and threats in the digital world, and determine their own strengths and weaknesses in digital marketing as they step into the digital world. It is just like starting a new company or presenting a new product or service to the market. Activities should also be shaped according to the analysis.

THE CONCEPT OF DIGITAL MARKETING

In summary, digital marketing activities can be defined as the realization of some of the marketing activities on digital platforms. According to the Digital Marketing Institute, digital marketing is defined as using targeted and measurable communication in a way that fulfills its marketing objectives by using digital technology (Smith, 2007). Digital marketing can be defined on the basis of the Internet as a form of marketing that makes use of the opportunities provided by technology and makes marketing activities more effective and more comprehensive, and thus it enables a company to reach to wider audiences (Merisavo, 2006, p.6). Digital marketing can be defined as an interactive marketing approach, according to traditional marketing, by gaining the ability to interact with consumers and act according to consumer behaviors (Deighton, 1996, p.151). A feature of digital marketing is its ability to offer a multi-channel

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purchasing experience. Consumers can make purchases through the internet, social media, e-mail, etc. (Chaffey, 2010a).

Marketing activities in the digital environment are much more cost-effective than traditional marketing activities. Therefore, reaching too many people within a very short time and delivering the right message to the right audience have triggered companies to adopt digital marketing.

The marketing activities in digital media provide several advantages to companies, from promotion to sales and from after-sales services to communicate with consumers according to traditional marketing activities (Dholakia and Bagozzi, 2001, p.168).

Furthermore, with their digital marketing activities, companies can also create a digital brand image such as brand images that exist in the physical world. Due to advantages such as unrestricted connection, accessibility, and mobility provided by digital media, companies can reach much wider audiences related to their products/services, sell their products/services, perform after-sales services more effectively, manage complaints more easily, interact with customers, and potential customers more can communicate (Wymbs, 2011, p.95). The most important benefit provided by digital marketing to companies is that it can be measured and realized for the target audience (Royle and Laing, 2014, p.68). Other benefits of digital marketing activities can be counted as learning online market share, identifying online customers' habits, creating online customer value, speed, engagement, targeting, low cost, optimization, being an agenda, and staying up to date (Taş, 2018; Gökşin, 2017). Without a digital marketing strategy, companies will miss opportunities and lose business (Ryan, 2017).

Wind and Mahajan (2002) summarized the new rules of digitalization in marketing. Accordingly, the innovations brought by digital marketing can be seen in Figure 1.

Figure 1. New Rules of Marketing
Source: Wind and Mahajan (2002)

The New Rules of Marketing for the Global Digital World

The New Reality of the Global Digital World

- The cyber consumer.
- The cyber B to B world.
- Marketing in the age of a complex, dynamic, and chaotic world.
- New business models for the digital world.

The New Rules

1. Target segments of one and create virtual communities.
2. Design for customer-led positioning.
3. Expand the role of branding in the global portfolio.
4. Leverage consumers as coproducers through customization.
5. Use creative pricing in the Priceline.com world.
6. Create anytime-anyplace distribution and integrated supply chains.
7. Redesign advertising as interactive and integrated marketing, communication, education, and entertainment.
8. Reinvent marketing research and modeling as knowledge creation and dissemination
9. Use adaptive experimentation.
10. Redesign the strategy process and supporting organizational architecture.

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Chaffey (2010b), in his study, also provided a road map for what companies should pay attention to when determining their digital marketing strategy. Accordingly, digital strategies should provide a future direction to Internet marketing activities. This includes articulating goals for digital channels that support marketing objectives that involve selection of strategic options to achieve goals for digital channels and creating sustainable differential competitive advantage. Furthermore, strategy formulation should include typical marketing strategy options such as target markets, positioning, specification of the marketing mix, defining which strategies not to pursue, the functionality which is not suitable to implement, and specifying how resources will be deployed. Therefore, the company will be structured to achieve the strategy that is needed.

4 P in Digital Marketing

In order to be able to adapt to industry 4.0 in marketing activities, it is necessary to digitize the marketing mix elements first.

Product

With the reflection of the digital transformation in the world on production technologies and products, the concept of the traditional product is also changing.

The first thing which must be considered is if the product/service can/will sell online, and which digital channels are suitable for the product/service (Kingsnorth, 2016, p.9). More so, the core product and services become increasingly digital when the core value of the product is increased with the value derived from digital enhancements (e.g., cars with GPS systems), an increase of online sales, smart products, and if the products/services are digital (video, music, etc.). This can be considered as proof that the concept of product in the traditional marketing mix should also change. With products being increasingly integrated and networked with digital technologies, it is important to understand the usage and connectivity contexts of products and the impact these contexts have on the utility derived from products (Kannan, 2017, p.36). When companies offer products in the digital market, the value created by the product must also be at the forefront. Consumers should believe that the products or services offered will add value to themselves (Ryan, 2017, p.44). This can be explained by the fact that when the product or service offered online does not meet the consumer expectations, the responses can be spread quickly through the internet. In addition, the products to be presented in the digital market should be presented differently according to the target audience characteristics (Stokes, 2013, p.24). Thanks to the internet and mobile technologies, the developments in automation processes and industry 4.0 will require deep-rooted innovations in production systems.

Price

When compared to the pricing practices in traditional marketing, the prices of products/services updated in the online environment is increasing so quickly. Thus, the use of conventional pricing methods in digital marketing activities is lagging behind in terms of sustainable competition. Digital products and services also have very low or zero marginal cost for production and distribution. This has important implications for pricing and revenue models, especially in the context of product lines consisting of

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traditional formats as well as digital formats (Kannan, 2017, p.37). With the help of information technologies, buyers can easily compare the products and prices of different companies. Thus, they have the chance to try to get the most suitable option for themselves. In addition, by means of technology, resellers are also able to have access to detailed data on issues such as spending limits, export products, and prices they form in the direction of the future (Met and Oktay, 2011, p.59-60). In digital pricing, companies can use dynamic pricing or price differentiation for their digital marketing strategies, and this can be very beneficial to them. On the other hand, one of the important advantages of the Internet is the personalization of the customers and the possibility of personalizing the prices. The pricing of products and services online is more dynamic for a number of reasons; firstly, search costs for consumers are low, menu costs for retailers are low, changes in the shopping environment are rapid, and lastly, retailers can respond to customers' searches more quickly (Kannan, 2017, p.38).

Promotion

Promotional activities can be defined as all activities that are carried out in order to introduce goods or services to the market, to reach new customers, and to keep old customers. The changes in the concepts of product and price together with digitalization are also manifested in the concept of promotion. Digital advertising is a form of promotion that uses the Internet for the express purpose of delivering marketing messages (Robinson, Wysocka, & Hand, 2007). In order to reach potential customers, target audiences and to establish sustainable communication with them, they have acquired a wide range of activities. Online promotion efforts will become much more integrated and interactive along with the Internet of things and industry 4.0. E-mail marketing, display advertisements, or social media marketing can be examples of digital promotion applications. These are explained widely below.

Place

Place is another important marketing tool for companies. Nowadays, a company can sell its products/services without a physical store. Thus, for the right place strategy, the web site must be easily accessible and be in good working condition. When a customer or potential client wants to find companies' products or services, he/she must find the website upper place in search engines. Products and services can be offered through sales 24 hours a day to 7 days a week in digital marketing vs. traditional marketing. The most important thing here is that the company knows which digital platforms the customers of the target audience use and that they can use their products and services through these platforms (Stokes, 2013, p. 25). Sometimes customers are looking at products in physical stores and then prefer to buy online because it is quick and easy. Therefore, it would be useful for companies to develop marketing campaigns to integrate offline and online stores. For example, Ikea successfully implements this strategy. Using the AR application in their marketing strategy, they make sure that furniture that is purchased without going to the store will experience how to look at the customer's home (Kotler et al., 2017: 193). Industry 4.0 also affects distribution activities. Factors such as stock management, order management, multi-channel distribution of the distribution channel structure, intelligent production systems, smart labels, changing the supply system will change the distribution activities.

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Preparatıon of Digital Marketing Plan

It is of vital importance for companies to make a marketing plan in order to be successful in marketing activities they intend to perform on digital platforms according to industry 4.0. Firstly, digital marketing activities should be planned according to the objectives of the company. Thus, companies should plan their targets and analyze to see their status in the digital world. For example, a SWOT analysis can be useful for companies to ascertain their weakness and strength and also the threats and opportunities. For example, concepts such as the company's brand name, quality, number of followers can be expressed as strengths of the company. Not having a strong web site can be identified as the company's weakness. While assessing opportunities in the environment, digital tools that competitors have not previously discovered can strengthen the company. And competitors to be more powerful than you in digital media can be identified as a weakness (Gökşin, 2017: 13).

When planning the digital strategies, it can be beneficial for companies to consider a specific, measurable, achievable, relevant target. The digital marketing plan to be formed by the companies can be grouped under six steps. Accordingly, the stages of the digital marketing plan can be listed as follows (Parlak, 2018).

Determining the Objectives and the Target Audience

The companies that want to operate in the digital world are primarily to determine their digital marketing goals. For example, within a period of 6 months to reach 100,000 subscribers or 1 million visitors within a year. Reaching such goals can be determined. In order to achieve these goals, the digital marketing activities to be used should be arranged. Thereafter, it is tested to determine the characteristics of the potential target audiences and potential visitors such as purchasing habits and demographic structures. The integration of industry 4.0 and network-based platforms will make it easier to identify market research and target audience.

Digital Branding and Differentiation

At this stage, companies should determine which aspects they differ from other companies in the digital world. Companies should prepare a website if they do not have. However, if there is a website already available, it should be investigated whether this website is current and if it meets the requirements of visitors. The company's website should use the same language as the target audience. Through this way, visitors to the site may stay longer on the site. Companies should create strategies for brand awareness in their digital marketing plan. De Chernatony (2001) suggested that delivering the online experience promised by a brand requires delivering rational values, emotional values, and promised experience.

Traffic Sources

At this stage of the digital marketing plan, companies should identify which potential target audiences visit digital resources. The target audience should be contacted through social networks, blogs, and forum pages. Companies should make a plan for the content they wish to share on the internet. For example, will the blog be written or will the content be created for social media accounts? How many times will

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the content be shared during the week? On what time interval will these contents be shared? Will the content be prepared by the employees of the company or will they receive professional support? Finding answers to such questions can be shown as examples of the content planning of companies (Karaman, 2018). According to Agrawal, Arjona, and Lemmens (2001), encouraging returning visitors to e-commerce sites is the most important tactic to achieve when reviewing performance metrics. The results of their study expressed that a 10% increase in the rate at which visitors are converted into repeated customers drives a 10% improvement in the net present value of a company's expected cash flows.

Competition Analysis

When analyzing how companies can reach customers in the digital world, they should also examine their competitors as well. Activities such as promotion strategies used by competitors, pricing strategies, and social media management should be analyzed. In addition, the company should determine its own positioning strategy.

Digital Marketing Channels

At this stage, it is necessary to determine which digital channels the customers and competitors use effectively. After obtaining the statistics, using the various metrics and the digital channels used by the competitors and customers, the company must activate its own digital marketing channels.

Evaluating the Results

The digital marketing plan should be evaluated with the feedback from the customers at certain periods and necessary changes should be made, and an effective digital marketing plan should be formed. After creating the plan of digital marketing, companies should begin to set up their digital marketing strategy.

Stages of Dıgıtal Marketıng

Digital marketing strategies can be expressed as a process of four stages. Accordingly, the first stage of the process is to acquire; the second stage is to convert; the third stage is to measure and optimize, and the last stage can be defined as retain and grow (Koçak Alan, Tümer Kabadayı and Erişke, 2018, p.495).

To Acquire

The first stage of digital marketing activities is to attract customers to the website. In this respect, companies are trying to make the website friendly to users by using different digital marketing strategies. Companies should be aware that a well-designed website is the first step to interact with customers. Therefore, businesses should first review their websites and change the errors they realize. Companies should act with the aim of creating a website with their own domain names while preparing their websites, and they should avoid annoying visual and content (Ryan, 2017, p.81). Marketing strategies used for this purpose are: Search engine optimization (SEO) and search engine ads, affiliate marketing, e-mail marketing, social media marketing, viral marketing, mobile marketing, and display ads (Koçak

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Alan, Tumer Kabadayi & Eriske, 2018, p.495). These strategies are well described in detail in Digital Marketing Strategies.

To Convert

In the second stage of the digital marketing strategies of the companies, activities are carried out to convert potential customers who visit the website into real customers. In order to convert the website visitors to the real customers, the businesses can improve strategies such as accessibility studies, content management, increasing the usefulness of the site, convincing messages, personalizing the customers, segmentation, and effective focus on these segments (Chaffey et al., 2013, p.189).

To Measure and Optimize

At this stage, companies measure the success of their digital marketing activities with various software and programs. They also measure their status against their opponents. The most significant advantage of digital marketing is the accurate measurement of marketing activities. In this way, the customer profile, the most interesting product, the most purchased product, the most-watched advertising, and the traffic coming to the site can be measured objectively. In addition to the measurements related to the website, the company has the opportunity to make measurements related to social media.

Retain and Grow

In the last stage of the digital marketing process that will be implemented by the companies, the companies try to make the success they achieve by using various marketing tactics. At this stage, applications such as customer satisfaction programs, loyalty programs, pricing strategies, and reference programs are emphasized (Chaffey et al., 2013, p.193).

DIGITAL MARKETING CHANNELS

The internet-based systems of industry 4.0 have enabled the emergence of new digital channels for marketing activities as well as production processes. Companies use digital marketing channels to reach costumers effectively and wish them to be regular costumers in the future. Most important digital marketing channels can be shown below.

Search Engine Optimisation (SEO)

Search engine optimization allow customers to acquire free information on products and services and identify firms and brands that fit their search criteria ((Kannan, 2017, p.24; Giomelakis and Veglis, 2016, p.380)).

The aim of SEO is to attract free visitors to the website by taking the top rankings in search engines related to company/product/ brand. SEO studies should first be started with identifying keywords. Here, it can benefit from free external sources, as well as free services of search engines. The keyword must

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be selected among the words that are highly sought after by visitors. In order to measure the success of the SEO study, criteria such as an increase in organic traffic, non-brand organic traffic, and list number of keywords should be evaluated (Şengül, 2018, p.82-85).

One of the most important issues to be considered in SEO studies is content optimization. According to this, the content to be created must be current, be well read, be useful, be of a certain length, including the keyword with other related words, and it should be linked to other pages linked to the keyword. Besides the editing of the produced content, it is also important that the referrals made from the other sites to the website of the company are made to the relevant pages. This is because the referrals from the news sites are high and are high-quality links. The technical features of the websites that will be prepared by companies are also important criteria to be considered in terms of SEO. For successful SEO, the website should be compatible with all screen sizes (laptops, tablets, and smartphones) (Şengül, 2018, p.89). SEO can be separate as online SEO and Offline SEO and both of them aims to be on the top of the searching results (Gökşin, 2017, p. 40).

Search Engine Advertising

This strategy can be defined as attracting visitors to the website by providing advertisements with paid listings on search engine result pages (Şengül, 2018, p.64). Search engine ads are charged with pay per click and post per click. Unless the ad is clicked, the advertiser is not charged. The topmost site in the ad space is the website that makes the most payments to the search engine. In PPC ad pricing, the search engine determines the price per click on the targeted keywords by considering the search rates of the users and the competition with other sites. PPC ads, which provide a fast promotion, are an important promotional tool, especially for newly established websites. This is because it takes a long time and effort to display naturally in the first pages of search engines. At the same time, target groups can be easily determined by using PPC advertising campaigns and ease of analysis is provided (Sener, 2014).

Affiliate Marketing

Affiliate marketing includes receiving payment when the target of the advertised company/brand is completed by using various marketing techniques. In affiliate marketing, if the consumer visiting the website of the company/brand makes purchases from this website, the publisher called affiliate receives a certain commission from this purchase. The publisher partner and advertisers meet on a certain network (Şengül, 2018, p.107).

There are three types of revenue models in the affiliate system. These include CPL: Cost-Per-Lead, CPS: Cost-Per-Sale, and PPC: Pay-Per-Click (Broussard, 2000: 440). Affiliate Marketing can be defined as a digital marketing method based on a rewarding system that companies incorporate in their marketing system. Affiliate marketing, which provides both low costs and a serious time saving for manufacturers and intermediaries, provides a significant decrease in advertising costs (Doğan, 2017, p.14). With the right affiliate marketing strategy, companies can make money without having an extreme volume of traffic coming to their website (https://pbsmarket.com/affiliate-marketing). For example, Amazon is the online marketplace that can deliver anything you want so, Every niche has its space on Amazon, which is why it's such a great starting point for an Affiliate Marketing venture (Spilka, 20018).

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E-mail Marketing

E-mail marketing can be defined as the delivery of marketing activities to consumers via e-mail. E-mail marketing is used extensively at every stage of the marketing process until the consumers' ideas and opinions are gathered in the product development process, customer relations, and in providing the brand image (Deniz, 2002; Haşıoğlu, 2006, p.96). There are three types of e-mail messages. Companies should develop a strategy by distinguishing these three groups in e-mail marketing. The first one is the messages for communication, which are shown to be a fast and effective means of communication. The second type of messages is informational messages. In the foreground, secret messages are used while informative, educative, and conscious messages are displayed in the foreground. The third type is direct e-mails with advertising content. Such messages are used for the purposes of highlighting the product in its entirety, reporting an important date such as opening, informing about campaigns, and activating the purchase. The use of e-mail in many applications that disturb the user, such as ad messages sent in single or in bulk, information to deceive and malicious software, are considered as spam (Haşıloğlu and Süer, 2010, p.62-63). For example, Uber's email campaign is very simple, yet tasteful. Uber gets straight to the point in their newsletters. The text is usually very brief with a clear CTA, which is perfect for subscribers who don't have a lot of time and just skim the message. For those who want to learn more, there is always a link visitors can follow. Uber always send different promotions and provides an amazing map of visitors rides, with a detailed map of visitors journey (Watts, 2018).

Social Media Marketing

Direct or non-direct marketing activities through social web tools such as social networks, blogs, social marking and content sharing, enabling awareness to promote a product or service, increasing brand awareness, and taking action to the firm or product / service, can be defined as social media marketing (Gunelius, 2011, p.22). Social media marketing is much more cost-effective than traditional marketing methods and it offers opportunities for direct communication to large audiences at any given time (Kaplan and Haenlein, 2010, p.62). By using social media marketing, companies try to fulfill the goals of creating sustainable brand awareness, informing followers instantly and in detail, developing creative and innovative alternative marketing strategies, establishing an interactive communication, and enabling customers to communicate among themselves (Özgen and Doymuş, 2013, p.96).

The main element of social media marketing is to determine the frequency of usage of social media, usage habits, and interests of users. In this way, producers can identify more effective marketing strategies by obtaining qualified information about what they need to offer their customers on social media (Say, 2015, p.20).

For example, Burger King took the issue of net neutrality head-on by creating an entertaining educational video on the topic. The video generated 1.5 million views on Twitter, 4.6 million on YouTube and 15 million on Facebook (Agnew, 2019).

Viral Marketing

Viral marketing refers to the promotion of products, services or brands, increasing sales, and increasing awareness through the dissemination of various). Contents related to the products or services of the com-

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panies through the internet. Viral marketing is a kind of technological communication which provides information about companies' goods and services, which is usually carried out in digital ways, spreading rapidly like viruses, and providing information about company's brand or product. The information required to be communicated by companies through viral marketing can easily spread to large masses (Gülsünler, 2014, p.77-78). Although the most well-known examples of viral activities are fun pictures and jokes, viral applications are increasingly being used as marketing practices to achieve company goals (Ünal, 2012, p.74-76). Using celebrities for brands digital marketing campaigns can be viral. For example, Kai, a member of K-pop group Exo, appeared at a Gucci fashion show. As you can expect, it went viral. And it reached 1,279,825 total conversations (Agnew, 2019).

Mobile Marketing

The increasing usage rates of mobile devices combined with the fact that the internet has become mobile has made mobile platforms a marketing tool for companies. Mobile marketing can be defined as the realization of marketing activities via mobile devices. Mobile marketing is also defined as the activities related to the promotion of goods, services, and ideas through mobile phones and sending messages aimed at establishing communication with target customers (Barutçu, 2011, p.9-11). Mobile marketing provides companies with two key benefits based on the features of mobile devices. These benefits include; mobile devices are always active and these tools are always together with the user. In terms of companies, these benefits create the opportunity to reach the desired audience at all times (Armağan and Gider, 2014, p.28-30). For example, Hilton is looking after their clients through an update to their Hilton Honours app. The app allows guests to check into their hotel room and customize their stay from their smartphones. with the app, guests can book any of 4000 hotels worldwide, view current and previous reservations, find out the latest promotions and deals and soon, guests will be able to open the door to your hotel room with your smartphone (Jackson, 2018).

Display (Banner) Advertisements

These ads are display ads on websites. They can be published in different formats such as text, visual, and video. Display ads are also referred to as banner ads. The purpose of display advertising is to convey the message to be given by the company/brand by delivering the advertisements to the masses and to increase brand awareness. The basic principle in Display advertising is that there are advertising banners on websites; some of which are mobile and active and some of them are inactive in the area which is allowed by the site owners. The importance of this form of marketing is that ads are interesting (Doğan, 2017, p.13).

Content Marketing

Content marketing can be described as a strategic marketing approach, focused on creating and distributing valuable, relevant, and consistent content to attract and retain a clearly defined audience and, ultimately, to drive profitable customer action (https://contentmarketinginstitute.com, 2018). The strategy of content marketing is adapted to each company, but it must consider the following elements: objectives of content marketing, analysis of the target, type of used content marketing, promotion channels, content marketing

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timetable (frequency), as well as metrics for measuring the impact of marketing content (Baltes, 2015, p.114). The objectives of the content marketing can be counted as; creating brand awareness, building engagement with the target audience, creating needs, developing brand loyalty, and testing a product (Ionescu, 2015). Also, analysis of the target audience can be described as identifying the target audience's or potential clients' demographic features, likes, interest, social media habits, etc. In addition, it must take into consideration four types of metrics: Consumption metrics (Google Analytics, Traffic, Open Rates), Sharing metrics (Retweets, Forwards, Likes), Lead metrics (Leads generated), and Sales metrics (Deals). A well-defined strategy of content marketing has the ability to create privileged relationship with the targeted audience by building a positive brand image. Thus, content marketers can attract, engage, audiences in the long term (Baltes, 2015, p.115). Content marketing plays an important role in companies. Thus, companies must have a content marketing strategy. According to literature, it can be said that companies are getting back positive results from using content marketing, such as; customer satisfaction, making the purchasing decision easier, and creating brand awareness both in B2B marketing and B2C marketing (Gupta, 2015).

When thinking about the examples of content marketing done right, it can be said that Hubspot's always on the list. In addition to creating a free tool as a growth hacking strategy, Hubspot has used content marketing by: Writing in-depth blog posts about the issues their visitors care about, Adding content upgrades such as ebooks to their blog posts and Creating an educational and content sharing hub, Inbound.org(which gets 321,000 visitors each month) and provides a great opportunity to promote its certification and partnership programs (Hurley, 2019).

DIGITAL MEASUREMENTS

The most important reasons why digital marketing is important for companies is the fast and accurate measurement of marketing activities. Thanks to industry 4.0, companies can measure important marketing data easily. With these measurements, data about site performance, traffic to the site, visitor movements, and visitor profiles can be obtained. These measurements help people who carry out marketing activities to a great extent. Marketing activities that cannot be measured cannot be managed effectively and necessary improvements cannot be made. One of the most important differences in digital marketing techniques from traditional marketing methods is that more objective and reliable measurements can be made (Altındal, 2013, p.5).

Measuring in digital marketing is extremely important. No matter which digital marketing tool is used, three basic components must be considered when planning. These components are; Behavior, Amount of Change, and Time (Hemann and Burbary, 2013, p.14). The most critical component aim is the setting. Companies should consider the setting if they are trying to increase awareness with the target audience or if they will get the target audience to take some sort of action. This can be explained as the behavior component. Also, it is important to identify how much the company wants the behavior to change. It can be expressed as a raw number and can be explained as the amount of change component. Hence, every aim should have a time element.

Methods to measure the results of digital marketing activities in general include; social media metrics, native ad metrics, content marketing metrics, digital campaign metrics, and Key Performance Indicators (KPI).

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Social Media Metrics

Social media analysts obtain data from users via social media platforms such as blogs, microblogs, social networks, wikis, social bookmarking sites, and multimedia sharing. Social media analysis are then used to analyze such data and to create processable information. Some of the collaborations related to social media measurement can be grouped under Digital PR, Online Reputation Management, Social Media Monitoring, Campaign Management, and Social CRM (Aytekin and Değerli, 2014, p.6-9). Social media measurement activities generally consist of four basic steps: monitoring, measurement, analysis, and reporting. There is popular software used at the global and local level in relation to social media measurements (Kaya, 2014, p.62-64; Kızılırmak, 2015a).

Native Ad Metrics

While Native Advertising is a fairly new concept, it is an advertising model which very large brands are now increasingly involved in. It is possible to describe Native ads as advertisements that are published in order to give information that meets the expectations of the target audience, consisting of the content in blogs, videos, infographics or other formats for a certain fee. Native ad contents are often presented to the target audience as sponsored content without creating ad sense. Brands are trying to reach consumers with native advertisements through social channels, websites or other digital channels. The transformation of native advertisements is evaluated based on the brand's long- or short-term goals. Therefore, to measure the success of native advertising, targets must be set before the campaign is published. After determining the specific targets to be reached by native advertising, two basic metrics are used to measure the transformation during the campaign. These metrics can are the time spent on the brand page and the returns from ads (Kızılırmak, 2015b).

Content Marketing Metrics

The fact that companies produce and publish creative and interesting content while using digital marketing tools provides many benefits. Creative content, produced with the right strategies and tactics, contributes to the achievement of marketing targets. Some metrics that are used to measure the return on content marketing are: Consumer Retention Metrics, Sharing Metrics, Interaction Metrics, Potential Customer Creation Metrics, Sales Metrics, Production Metrics, and Cost Metrics (Kizilirmak, 2015c).

Digital Campaign Metrics

Measurement of digital campaigns' reach to the target audience can be done via computers and all mobile devices. and the target population can be reported individually among different devices. The methods used to measure the display rates of digital campaigns should be capable of distinguishing impressions from bots and fake. The basic metrics that must be evaluated in a digital campaign measurement are Tagging, Counting, Matching, Tuning, and Reporting (https://digitalage.com.tr, 2017).

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Key Performance Indicator (KPI)

KPI is an acronym for Key Performance Indicator. KPI expressed as the most desirable goal is also a very important performance scale. The KPI is often used to assess the success of companies in the field in which they operate. The number of new customers, sales increases, and annual profit rates is considered as KPIs. In terms of digital marketing, the KPI includes metrics such as social media interaction figures, singular rating rates, number of monthly clicks, number of shares, and time on site. Therefore, companies can create KPIs based on the objectives of the digital marketing strategy and evaluate the effectiveness of the digital marketing campaign by measuring the KPIs created (Faith, 2017).

For companies, an appropriate KPI framework should distinguish between the evaluation of customer acquisition, customer conversion, and retention for reporting, and analysis of the effectiveness of digital marketing activities for those responsible in each area. It also should define different classes of measures from operational to strategic importance. Chaffey and Patron (2012), developed a framework has four steps which include; reach, act, convert, and engage. Reaching can be described as building awareness of a brand, its products, services on other websites, and an off-line media in order to build traffic by driving visits to different web presences such as a company website, microsites or social media sites. In this step, companies can track metrics like Unique visitors, New visitors, Visits or Conversation volume. The second step of the framework is to persuade or prospect costumers to take the next step of interacting when they initially reach a site or social network. Companies will do this by engaging customers with blogs or social media contents. In this step, Online opportunity volume and Offline opportunity volume can be used as tracking metrics. The third step can be defined as conversion, where the visitor commits to forming a relationship that will generate commercial value for the business. Also in this step, Online sales volume and Offline sales volume can be used as tracking metrics. And the last step can be defined as building customer relationships over time to achieve retention goals through activities such as E-mail marketing. Also Neely et al. (2002). suggest that companies have to ask themselves if they really measure what they set out to measure; “Are they only measuring what they set out to measure? Is this the right measure of the performance measure they want to track? etc. With testing these questions, companies can measure KPIs efficiently.

CONCLUSION

With Industry 4.0 adaptation, the production line, procurement and distribution systems, promotion activities and price regeneration are required. these activities are the basic marketing activities of the enterprises. Industry 4.0 is defined as a period in which the interconnected processes communicate, communicate over the internet, collect data and completely change the production process, emphasizing the interaction of machines with people. Industry 4.0 is a system supported by self-regulatory solutions through autonomous production systems and extensive network communication of objects based on the Internet. In addition, Industry 4.0 is a system that directs businesses to integrate with each other and their customers through internet and artificial intelligence (Yazıcı, 2010; Toffler, 2008; TOBB, 2016, Gür, 2017). therefore, enterprises should prepare for the industry 4.0 by digitizing the basic marketing activities.

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The use of internet in the companies' world, changes in communication technologies, and digitalization in the company processes require companies to keep up with this transformation. Companies that can keep up with digital transformation in industry 4.0 will have a more sustainable competitive advantage. Digitalization of companies will affect all processes of marketing activities. Companies that want to step into the digital world should first determine their basic goals and strategies.

Considering these characteristics and innovations brought about by industry 4.0, it can be stated that companies that want to adapt themselves to this new system should carry out also a transformation in their marketing activities for effective competition. The reason why companies should adjust their marketing activities to this world can be explained by the evolving of marketing from the past to the present. Marketing 4.0 can be described as the sequel to our widely-recognized concept of Marketing 3.0, which calls for brands to touch the human spirit. Marketing 4.0 is based on intricate observation and analysis of the paradoxes because of the digital technology era. Thus, at this point of view, companies have to realize that digital transformation is essential for them and begin to prepare all the processes for digital transformation.

One of the reasons why companies need to adapt to the digital World and industry 4.0 is to make consumers and competitors come online. For companies that spend most of their time on digital platforms, it is inevitable that the marketing activities will be carried to the digital environment.

Companies can use very different strategies in their digital marketing activities. In order to identify these strategies, companies must first establish a digital marketing plan. Once the company's digital marketing goals have been set, digital marketing activities can be grouped under four headings. The first action a company has to perform is identifying specific keywords to attract visitors to the website. For this purpose, digital marketing tactics such as affiliate marketing, social media marketing, e-mail marketing, and SEO can be used. The purpose of attracting visitors to the website is to turn the visitors into customers. In the second stage of the digital marketing strategies of the companies', activities are carried out to convert potential customers who visit the website into real customers. Companies have to measure the success of their digital marketing activities with various software and programs. And measure their status against opponents at the third stage. And in the last stage of the digital marketing process that will be implemented by the companies, the companies try to make the success they achieve by using various marketing tactics such as, satisfaction programs.

For effective digital marketing, it would be useful to check the transactions done at certain times. Some basic rules to be considered for the control system can be listed as follows (Ertaş, 2017): The objectives and communication methods of each digital marketing activity should be determined. All objectives should be made up of targets that can be measured. How to evaluate the activities related to digital media should be determined. Non-digital methods and digital methods can be used for an effective digital marketing program. In campaigns that use more than one digital channel, the method should be measured which is more useful. In addition, digital media performances of competitors should be followed.

The most important contribution of digital marketing activities is its ability to make objective and rapid measurements. In this way, companies can achieve their goals, understand where they need to make changes, manage customer profiles, and manage customer complaints at a much lower cost and in a much more efficient way than traditional marketing activities.

Companies should not ignore the fact that in recent times, consumers spend a great part of their time on the internet. The last thing that people do before they sleep at night and the first thing they do when they are awake in the morning is to check their smartphones. Hence, it has become essential to imple-

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ment digital marketing activities in order to reach consumers who have access to the Internet with their smartphones at every moment of their lives for companies. Thus, this research is focused on providing suggestions about marketing strategies for companies that can be used for digital marketing activities while adapting themselves to industry 4.0.

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Chapter 7
Social Media as a Communication Channel

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ABSTRACT

In digital world, people spend most of their time on social media. Social media has gone beyond being just an online communication platform. It has become a channel that users prefer to other online platforms, such as websites, blogs, forums to get information about various businesses, events, and individuals. With Industry 4.0, all devices are connected to online platform, smart devices get more place in daily life. Instead of accessing information through individual applications, consumers prefer to obtain information from the company's social media pages and/or the company's internal and external customers' shared content. The purpose of the chapter is to indicate the importance of social media use, for organizations to interact effectively with all stakeholders, and to explain the benefits of social media usage of organizations in terms of different functions with examples from best cases and results of empirical researches.

INTRODUCTION

Today, the use of social media for organizations is no longer an option. With Industry 4.0, companies are trying to take advantage of information technologies to maximize profitability and productivity. Besides this, use of social media has increased in recent years and that made companies to show their presence on social media platforms. Social media is becoming a major source of excessive information for companies (Yilmaz et al.,2017).

Social media is also an effective tool of communication to establish social interaction within the organization and to maintain relations with outside parties. Communicating through both internal and external social media platforms has many benefits such as competitive advantage, corporate reputation and positive job attitudes.

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The mobile devices and social media are part of Industry 4.0 since the manufacturing environment is leading to real-time transparency, which will make production control, and management processes more flexible (Bauer et al., 2015). Although this "digital transformation" might seem challenging for the companies, many companies have already started their change process since they developed interactive websites, improved customer service.(Berman, 2012). However, big companies use mobile analytics and social media to change customer loyalty, internal communication and even their business models (Westerman and McAfee, 2012).

In this chapter the concepts of social media, social media marketing and enterprise social media are defined, the benefits and importance of social media usage for organization are indicated and, the role of social media as a communication channel for 21st century organizations are explained via cases and findings of empirical researches.

BACKGROUND

In the basic sense, social media is defined as any web site including user-generated content. Such as social networking sites (Facebook, Myspace), creative works sharing sites (Youtube, Instagram, Soundcloud), business networking sites (Linkedin), collaborative websites (Wikipedia), e-commerce communities (Ebay, Amazon), podcasts and open source software communities (Linux, R), social media can take many forms. In all these forms of social media, individuals can share their own content and make comments on other individuals' contents. Establishment of social networking sites such as Myspace and Facebook has changed the concept of "Social media" and made a contribution to importance it has today (Kaplan and Haenlein, 2010).

There are many reasons of using social media sites. Smith and Kidder indicated most cited two reasons of social media usage as: a sense of community and a sense of identity. According to Social Capital Theory people can benefit from strong and weak connections with others. Creating and extending a user's community, a network of relationships, provide common shared values and norms. In terms of business world such networks could help individuals to meet influential people and to find job connections (Smith & Kidder, 2010: 492). According to Social Identity Theory, at the growing stages people need to explore and expose their social identity. Also a positive sense of identity is important for self-esteem. It provides a feeling of belonging to a larger group. Especially for young people social media makes it possible to introduce an identity by posting photos, blogging, listing hobbies, sharing common interest with the community they want to belong (Smith & Kidder, 2010: 492). According to Zhao et al (2008) Facebook users check their profile to see their hoped-for possible selves. According to Liu (2007) there are two types of identities: the differentiation profiles and the self-enhancing profiles. The differentiation profiles represent people who want to be unique and different from others. On the other side the self-enhancing profiles, which are majority, represent people who want to be popular and similar to others.

The development of social media completely changed the way companies communicate with their employees and customers. There is a clear transition from traditional media channels to social media. Comparing these two media types, social media has two-way conversation, open system, brand and user generated contents. Also in social media, the most important actors are users and influencers, the language is informal and every user can involve actively. But in traditional media, one-way conversa-

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tion is used like broadcasting your message to as many people as you could afford then sit and wait. In contrast to social media, there is professional content, formal language, passive involvement and the leading actors are celebrities.

Social media is increasingly integrated in organizational practices as a communication tool not only among customers but also among employees, shareholders, competitors, suppliers and consumers. In other words, social media is an important communication tool to develop effective interaction between the organization and all stakeholders. Jurgen et al (2016) indicated that primary stakeholders (e.g., customers, suppliers, creditors, employees) traditionally are perceived as more powerful and urgent groups than secondary stakeholders (e.g., the general public, communities, activist groups). This approach makes companies tend to consider more the concerns of primary stakeholders than the concerns of secondary stakeholders. But in digital era the asymmetry of influence between primary and secondary stakeholder groups tend to decrease. Today companies have social media as an effective tool to governance secondary stakeholders as slickly as primary stakeholders.

Researchers have indicated that there are several significant changes to organizational practice as a result of increasing usage of social media. Some of these changes are listed below (Haefliger et al., 2011; Hu & Winstad, 2008; Von Krogh, 2012, Smith & Kidder, 2010):

- Managers could benefit from the cost advantages of social media and personalization of the target group at the social media in order to lead and influence online communities that the organizations have engaged in.
- The competitive advantage and the structure of organizations are more challenged and varied since stakeholder interaction and especially consumer interaction is adjusted to social media. From this perspective social media could be interpreted as a strategic tool, which mediates the relationship between organization and stakeholders.
- Communication among internal and external stakeholders via social media may facilitate appropriate creation of value.
- Firms want to increase sales by using agents on social networks for viral marketing, brand communities, ads in social networks that can direct the consumers' online shopping sites even ads that allow the customers to shop inside social networks. According to Business Insider Social Commerce 2017 Report, social media is becoming rapidly the most influential tool in consumers' purchase decisions .
- More and more organization are utilizing social media as an innovative recruitment tool or a talent pool rather than announcing the vacant positions via traditional media channels.

The following headings present examples and empirical researches on the benefits and the drawback of social media usage in terms of different aspects of business functions. We have specifically focused on internal and external environment and stakeholders of companies. Marketing, sales, brand communities, and consumer relations headings have been formed in order to evaluate the impact of social media usage on external stakeholders. On the other hand,enterprise social media, human resources, and job attitudes headings have been formed to evaluate the impact of social media usage on internal stakeholders. Business performance heading focuses both on internal and external stakeholders.

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SOCIAL MEDIA AS A COMMUNICATION TOOL FOR ORGANIZATIONS

Social Media Marketing

Marketing in social media requires more inspiring and attractive content to draw the attention of consumers. Compared to traditional media, social media can be quite challenging because it needs to maintain the consumer interest otherwise their attention will turn elsewhere (Peters K. et al., 2013). Peters K. et al. (2013) also state that the momentum of social media and the enormous amounts of data being created across platforms will make organizations "*feel the need for a central content hub that serves all channels on all relevant topics in almost real-time*" (2013, p. 295).

According to Kabani (2012) we need to give the definitions of social media and marketing separately before explaining social media marketing:

- Marketing: Creating a value, promoting a product or service to increase sales
- Social media: Mobile/online platforms where people connect and communicate

So, simply the social media marketing represents use of all social networks for marketing, creating value, public relations and customer relationship management (Barker et al., 2013). Today's common tools, social media applications and sites such as Facebook, Twitter and Instagram created new challenges and opportunities for companies to enhance communication with current customers and to collaborate in new channels with both current and potential customers (Culnan et al., 2010). As a result, most of the companies are adopting social media to increase customer loyalty and retention, brand awareness, customer satisfaction (He et al., 2013; Kietzmann et al., 2011), and to learn from customers (Saravanakumar and Lakshmi, 2012), to amplify public relations and to reduce customer acquisition costs (Tuten and Solomon, 2017). If we classify simpler, usual actions performed with social media applications, this classification contain branding, sales and customer relations (Culnan et al., 2010). For an example, like many accommodation chains, Starwood Hotels, have been benefiting from the opportunities of social media to stay connected and to get feedback from customers in recent years, they also help potential customers to make their travel decision (Reddy and Dula, 2010; Müller,2011).

Social Media and Brand Communities

Marketers are enthusiastic to create and organize brand communities (McAlexander et al., 2002; Schau et al., 2009). Brand communities include cluster of relationship and connections among people who love a brand (Muniz and O'Guinn, 2001). With the help of learning how brand communities work, companies can observe customer perceptions of brand, new products and competitors; companies also can increase their chances to attract and work together closely with loyal customers of the brand (McAlexander et al., 2002; Franke and Shah, 2003). Being close to loyal customers allows companies to discover how the influencer members make evaluations and acts (Muniz and Schau, 2005), and also allows them to observe rapidly diffusing information among consumers (Jin et al., 2009).

Combining the brand communities and social media communities leads to a concept that can be called "virtual brand community" or online brand communities (Laroche et al., 2012). Social networking sites such as Twitter, Facebook, Instagram allow users to discuss about different issues and topics

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freely. People register for these sites and other such sites and use text, photographs and videos to keep in touch with their friends, make new ones, exchange experiences, play games, gossip, exchange intellectual knowledge, trade, fall in love, and brainstorm (Lenhart and Madden, 2007; Laroche et al., 2012). Compared to social media, traditional media users consume the content passively. In contrast, social media community members create content through active participation in virtual brand communities. This active structure forms the character of the community and users' influences on each other (Bagozzi and Dholakia, 2002).

As it can be seen in the previous studies, companies can have different objectives and motives behind using social media and creating virtual communities. For example, Chase Cards used social media and mostly influencers to create a new millennial cult brand. On the other hand, Pepsi refresh project targeted millennials and challenged them to refresh and renew their world.

In August 2016, Chase Card Services of JPMorgan Chase, had launched the Chase Sapphire card and the card exceeded the 12 month sales target in 2 weeks. The most important detail was more than half of the new customers were under 35 years old. The reason that drove the social media and the word of mouth was the 100.000 points sign-on bonus. The size of bonus had been drawn the attention of famous bloggers such as Brian Kelly, CEO and founder of The Points Guy, who claimed that "the most appealing card ever".

At launch, Sapphire team knew that the millennial consumers were consuming media differently, rather than traditional media, they preferred media platforms and influencers. So the marketing team approached differently; they engaged relevant influencers, models, and designers such as Nigel Barker, Kelly Wearstler and Chrisy Teigen. They shared their unique experiences through different social media and these contents reached millions of millennial followers. Fueled by proper usage of social media channels and online forums, news spread quickly and the card reached its annual customer target in two weeks after launch. More than half of these consumers were millennials and they were proudly posting photographs with their new Chase Sapphire cards on Facebook, Twitter and Instagram. Some were uploading "unboxing" videos to Youtube. In the end, Chase created a cult millennial brand and build a brand community with the power of social media (Santana et al., 2017).

For the first time in 20 years, Pepsi announced that they would not run advertising for their brands during the Super Bowl in 2010. Contrary to expectations, the company decided to use 20 million dollars, this was the typical Super Bowl budget, for another marketing program. The Pepsi Refresh Project allowed consumers generate ideas to "refresh" their communities. Most voted ideas were awarded with grants. Grants ranging from 5.000 to 250.000 dollars would be awarded to ideas in six categories such as education, the planet, health, neighborhoods, arts & culture and food & shelter. To target the millennial audience, ideas (or projects) would be posted on socials media platforms and the voting would take place on these platforms. Consumers voted for ideas on Facebook and were encouraged to 'like' Pepsi Refresh project page to generate publicity. Before long, 4 to 5 million individuals were visiting the web site of Pepsi Refresh and half of the visitors registered on the site to share their ideas to win grants and coupons. After 2 months, Pepsi earned additional 300.000 friends on Facebook and project was generating 1000 tweets a day. Before the project, Pepsi was behind Coke in Facebook followers with 225.000 fans to 3.5 million. As a result of the project, 3 million Facebook and 53.000 Twitter followers were added and created a strong community.

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Social Media and Sales

After witnessing the power of the social media tools at the consumer community level, most of the marketers decided to embrace the ability to use these tools to spread their message to consumers (Andzulis et al., 2012). Big firms such as Ford and P&G planned to cut their advertisement budgets because social media can be more efficient than the traditional media that usually eats the lion's share of the firms' marketing budget (Edwards, 2012). There were many areas of the firms that have been changed by social media impact but the sales function had the potential of being the most significantly changing function by the technology and social media advancements; and it has changed dramatically.

E-commerce is becoming an important tool therefore, trendsetting companies are focusing on unique characteristics of social media. The "likes" in Facebook, Twitter or watching "story" in Instagram is not the most important activity (Anderson et al., 2012). In the present, we are on a phase that went beyond simple communication and influencing. To be more precise, firms want to increase sales by using agents on social networks for viral marketing, brand communities, ads in social networks that can direct the consumers online shopping sites even ads that allow the customers to shop inside social networks. According to Business Insider Social Commerce 2017 Report, social media is rapidly becoming the most influential tool in consumers' purchase decisions. As a matter of fact, the top 500 retailers earned an estimated 6,5 billion dollars from social shopping in 2017, up %24 from 2016 (Business Insider Social Commerce Report, 2017). In addition to report's results, social media is a large part of discovering products and research phase of the consumers' shopping experience. With more and more retailers offer quick access to their sites via social media pages and accounts and purchasable content become popular, it's inevitable that social media will play an even larger role in online commerce.

As it can be seen in Decathlon and Ford Fiesta cases, firms can use agents in social media to create buzz and make sales such as Ford Fiesta Movement or use social media to create awareness and canalize the users to online shopping site to increase online sales like Decathlon did in China. Decathlon, a large multinational French manufacturer and retailer of sporting goods with more than 400 stores operating in Europe and Asia, planned to establish its official Chinese online shopping website in 2011. After reviewing online markets and competitors, they began to take notice of the competitors' (Nike, Adidas and local companies Li-Ning and Anta) aggressive strategies to increase online sales. After that the executives decided to monitor Decathlon's current online marketing status and they deduced that while effort had been made to launch a website for online shopping, there had been no additional efforts made to attract customers to it. Therefore, the head of e-commerce department classified some of the most popular social media sites in China (Geng, 2011). Decathlon decided to try a forum site that has a real atmosphere and mentality to build a social community. They soon identified bbs.8264.com, a website about introducing outdoor activity knowledge, creating outdoor awareness and providing tips about outdoor activities. The members of community can share travel experiences, tips and photos therefore the interaction on this platform make the community grow continuously. Decathlon advertised strategically on the webpage which had the highest community member and least competition. These ads helped to create brand awareness successfully and directed consumers to online shopping site. Finally, Decathlon created an official account on China's important micro-blogging site Sina Weibo and had attracted thousands of followers in a short period. The firm used this platform to announce news and to launch discount contests. The micro blogging site move seemed to create some word of mouth and was shared by the followers. The increasing strength of micro-blogging granted the firm to reach immense

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number of social media users. After only 3 months, Decathlon generated exemplary brand awareness for its online shopping site with the help of social media mostly (Geng, 2011).

Ford Motor Company, initiated an ambitious new marketing campaign. Usually, the industry uses traditional channel advertising just a few months before the new car goes on sale. Ford Fiesta Movement(FFM), the new campaign's name, started nearly 1 year before the actual car was unveiled and went on sale. The objectives of FFM campaign were like any other typical marketing campaign for a new product: informing the target market segments and building awareness for the new product though, there were many challenges like building awareness for a car that had not been in North America for decades, being in a competitive segment and reaching target customers, young drivers in their 20s, who use traditional media less and less every day. The marketing team gave free Ford Fiestas to a carefully selected very small group. The 100 Ford Fiesta agents were asked to share their experiences on Youtube andTwitter no matter how negative they might be. After the campaign results were impressive. Agents had posted on Youtube, Flickr and Twitter about Fiesta and it created buzz virally. The video on Youtube generated 6.5 million views and the firm reported that 50.000 consumers had expressed their intention to buy Fiesta; 10.000 cars were sold in the first 6 days and %97 of these had not even driven a Ford before.

Social Media and Consumer Relations

The main difference between marketing public relations and the other types of marketing communications is the mediators that spread the message. Marketing Public relations is about creating buzz by drawing attentions of mediators like mass media, social media or the people who voluntarily spread a message about a company to their followers or audience (Papasolomou and Melanthiou, 2012). The unique difference of marketing public relations is putting another party in the communication process than the marketer therefore the message receiver creates a different dimension on his or her mind which can be both threat and opportunity.

Social media users, they can also be called non-media mediators, can either be a professional or a simple consumer who admires a brand or a company. Marketers using 'non-media mediators' expect them to influence their friends, family, professional and social groups through generated content in social media (Voight,2007). However, this also means that the marketers will lose control over the message since mediators usually do not simply deliver the messages but they also change them. As mediators use social media to connect with their followers around the world, companies have a great opportunity; to influence their mediators so that they can generate good publicity (Papasolomou and Melanthiou, 2012). Yet, social media creates an environment that encourages the individuals to generate bad publicity as well as good publicity freely. Example for bad publicity, in 2009 Domino's Pizza had been placed into a difficult situation. A video of two employees of Domino's had been posted online on Youtube. In the video which had gone viral, the employee sticks cheese up his nose before placing it onbread, sneezes on a pizza and boxes it for delivery. The other employee recording the video was heard laughing during the video and commenting, "in about 5 minutes, these foods will be sent to delivery and somebody will eat them." The video was shared in Facebook and Twitter and, as a result, had more than 1 million views (Bigus, 2011). Following the incident, Domino's fired the two employees and posted a video of them apologizing from the customers After two weeks, the buzz about the videos has subsided and customers were speaking more positively about the chain. According to the Vice president Tim McIntyre, it was due to the company reaching out directly to social networks. More examples can be given like this situ-

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ation, such as in 2016 Daimler Trucks and Buses' chief executive officer in China lost his temper over a parking space and Gartner, the CEO, used pepper spray and one of the bystander got injured. The story went viral, at no time Chinese social media, also newspapers and TV connected this negative situation to Daimler brand and most of them asked people to boycott Mercedes cars. This parking space quarrel not only resulted in social media outrage but also share price of Daimler dropped from 65,69 euros to 61,90 in 10 days (Messner and Yoon, 2018). For the good publicity example, Pepsi Refresh Project was designed to create buzz, celebrities such as Kevin Bacon and Demi Moore participated in a part of the project and this was announced for the first time in The Today Show. Facebook page of the project featured an exclusive chance to watch Pepsi Refresh Everything through Great Ideas brainstorm live. College students and executives of Pepsi Co. discussed ideas that would make positive impact to the world.

Enterprise Social Media

In organizational context social media has been used in two ways: internal and external. Most of the researches are focused on social media as a communication tool with external stakeholders such as customer, vendors, suppliers, competitors, and consumers. Running social media campaign, managing pages or blogs and microblogging in popular social media platforms are some examples of these attempts. Internal communication and social interaction via social media within the organization is less commonly studied field, which is more focused on enterprise social media platforms. Enterprise social media is defined as (Leonardi et. al. 2013):

''Web-based platforms that allow workers to:

- *communicate messages with specific coworkers or broadcast messages to everyone in the organization;*
- *explicitly indicate or implicitly reveal particular coworkers as communication partners;*
- *post, edit, and sort text and files linked to themselves or others; and*
- *view the messages, connections, text, and files communicated, posted, edited and sorted by anyone else in the organization at any time of their choosing.''*

Social media usage as a communication tool among employees is also improving in last decades. Organizations not only encourage their employees to use public social media platforms but also invest special social media platforms inside the company. These kinds of specific internal social media platforms are called enterprise social media. Organization as a sociotechnical system requires both communication about work-related issues and social interactions. Enterprise social media basically refers to web-based platforms used inside an organization to support internal interactions within employees. Most of the enterprise social media platforms allow users to send messages to coworkers, indicate the work team, post, edit and sort common shared work files, opening chat rooms or social groups etc. The difference of enterprise social media from public social media platforms is there is not a chance to communicate with outside parties like, customers, vendors, and competitor. Enterprise social media is also different from other internal communications technologies. Because it gives opportunity to distinguish work related and social conversations among users (Leonardi et al, 2013; Maqbel & Nah, 2017).

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There are scientific researches on how enterprise social media affects productivity, workplace integration, positive emotions and attitudes, knowledge share and management performance, and overall job performance (Maqbel & Nah, 2017). For example, Best Buy uses a web-based platform called Connect to let employees have a voice. Connect collecting all tweets, feeds, blogs in to centralize location. It is possible to reach an employee and ask technical questions and experiences with Connect (https://www.stayonsearch.com/best-buy-using-social-media-to-connect-with-customers, online December 28, 2018). Dell also has EnterpriseEfficiency.com for Information Technology executives to discuss and post about their experience about work (http://i.dell.com/sites/content/business/solutions/power/en/Documents/ps1q11-20110266-socialmedia.pdf, online December 28, 2018)

Although companies like, Best Buy and Dell, have succeeded in using enterprise social media to accomplish significant targets, such as reducing their costs, increasing revenues or stimulating innovation; many other companies failed to see beneficial outcomes of their enterprise social media platform or faced problems of communication based on posts of employees on that platforms. Huy and Shipilov claimed that a successful enterprise social media usage should support the development of emotional capital, which can be defined as '*the aggregate feelings of goodwill toward a company and the way it operates*' (Huy & Shipilov, 2012; 74). Emotional capital represents emotional based assets that the company has developed over time among their employees and executives. The findings of Huy and Shipilov research suggest that using social media to develop emotional capital among employees can improve information flow, collaboration among employees, increase motivation and decrease personal turnover. Unfortunately, some organizations that focus on getting work related information or formal community building processes instead of developing emotional capital, could fail to get benefits of enterprise social media (Huy & Shipilov, 2012; 73-74). For example, in 2016 at a software company called Fresh to Table's, executives fired an office manager after reviewing her conversations with some of other employees, who had been promoted recently, on the internal social media platform called Slack. The CEO and HR vice president figured out that the office manager was spending considerable time on Slack by humiliating other employees, talking about the times when they ran off work and, chatting on other questionable topics (Mukunda & Holtom, 2017).

Another example, Huy and Shipilov mentioned a technology company (writers keep confidential the identity of the firm) that invest an enterprise social media platform and hired some developers to build the tool. By this tool it is possible to send email, microblogging, creating groups etc. The company made participation to enterprise social media platform as a part of employees' performance review. As a result, nobody use the tool voluntary and executives couldn't get tangible outcomes from the initiative (Huy & Shipilov, 2012; 74-75).

In contrast Tupperware invest in an interactive motivational webcast called The Tupperware Radio Show, and become one of the significant cost drivers and example of morale in a direct sales industry. It's not because forcing employees to use that tools but because understanding of the importance of developing positive emotions through enterprise social media platforms (Huy & Shipilov, 2012; 75).

Social Media and Human Resources

Social media is not only for organizations to share information with shareholders, but also individuals as employees or job applicants are sharing information about themselves at social media. It is very easy to check many information via Googling or searching the name of person on social media. Employers

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commonly use social networking sites to obtain information for purposes of recruiting and assessing job applicants. Social media is an effective tool to gain information but employers have to be careful to use the information gained from social media. Because those information could bring bias, unethical or illegal practices based on violation of special life or individual's right to privacy. For instance, the life-style presented by the employee on social media may not be compatible with her social identity at work. Things that an individual share with her close social environment, such as drinking, cheating, boasting, may not be consistent with the desirable characteristics (such as being responsible, being mature, etc.) of social identity at work. Comparing the social identity showed at social media with preferred criteria of recruiting, promoting, performance evaluating, an employee or job applicant may be exposed negative bias, attitudes or assessments due to their post in social media. Smith and Kidder (2010) suggest organizations to develop guidelines and policies about the use of social media in application and evaluation processes. (Smith & Kidder, 2010: 491-493)

More and more organizations are utilizing social media as an innovative recruitment tool or a talent pool. Furthermore some organizations like accounting firm Ernst&Young use social media with intention to attract young graduates. There are also lots of special online hiring tools and social media websites like LinkedIn. The question needs to be answered is how or under what circumstances employers or even managers should use social networking sites as a means of evaluating job candidates or current employees (Bizze 2018: 30-31; Smith & Kidder, 2010: 494). For example, a non-profit organization at New York rejected an applicant since his Facebook profile shows that he has extreme romantic exploits and interest in violent movies. Company assessed him as a weak fit for the position (Smith & Kidder, 2010: 494). Another example is a company refused a 19 years old internship candidate because she was holding a bottle of vodka in her Facebook profile photo (Stone, 2006)

There is a little legal limitation to prevent employee to monitor their employers' social media accounts. (Smith & Tabak, 2009: 34-46) It is an arguable topic if it is also a privacy problem and, seems to be unethical monitoring people without their permission in an area outside of office space. On the other hand some of the employees may have consequences that could cause damage to the organization, and even the employer may even consider firing the employee. Downcity Motors case could be an example. Downcity Motors, which owned BMW, Range Rover, and Mercedes-Benz dealerships in Charlotte, North Carolina, is a small business and the owners of the company (Dell and Susanna) had been working in this family business for three generations. They had been called from the BMW headquarters and had been told one of their prized salesperson, Kenton, wrote something about the launch they had. The customer had implied that they need to keep a tighter rein on their staff. After hearing that, Susannah checked Kenton's Facebook wall and read: "So thrilled that Downcity went 'all out' for the most important Mercedes launch in years. Nothing says luxury like plastic tablecloths and soda pop." Kenton had posted a photo of a soda can with the Downcity Motors sign looming in the background. In Susannah's opinion, they needed to fire him because Kenton had shared similar negative posts on his Facebook account although he had been warned him before. He said that he was just sharing his work experiences with his friends and family (Watson & Lopiano, 2016). Another example is the two employees of Domino's Pizza who posted a video that one of them sticks cheese up his nose. In this case Domino's posted a video of employees and apologized from customers and also fired those two employees (Bigus, 2011)

Although there are examples of organizations which fires employees because of their inappropriate posts at social media, it is still possible to benefit from the use of social media. Determining the policies

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about social media usage can guide employees in terms of forbidden behaviors and posts of their work experience at social media. In order to make social media policy effective, it is also important to focus on how well employees understand their employers' policy about social media. O'Connor et al conducted an exploratory research about how young adult employees behave according to their knowledge about the social media policy of the company they work. They obtained data from 166 employed under-graduates of a university at United States. '*Only 31% of participants indicated their company had a social media policy; 34% indicated that their company did not have a social media policy; and 35% reported that they did not know if their company had a social media policy.*' Obviously employees seem to be not clear about organization's social media policy. O'Connor et al. recommend a clarification of the social media policies and trainigs on social media policies (O'Connor et al., 2016: 206-209).

Social Media and Job Attitudes

Its indicated that the effect of social media usage on many different job attitudes and behaviors such as organizational engagement, organizational identification, intrinsic work motivation, proactive work behavior, withdrawal and turnover.

Withdrawal and Turnover

There are many companies support their employees to use of social media sites like Facebook to interact with coworkers to improve coordination. Bizze (2018: 26-27) conducted a research with a sample of 277 employees of a Canadian healthcare institution, about the intention of social media use (for work or for leisure) in workplace and, found that '*employees who use Facebook to facilitate work in the organization have a 50% higher interest in other organizations on social media'*. Apparently there are paradoxically the risks of employee withdrawal intention and personnel turnover. In order to use social media as an innovative recruitment tool, Bizze mentioned some recommendations such as publishing professional content, setting social media referrals, tagging employees, sponsoring recruitment campaigns and events, publishing employee content, opening social media groups and conducting social media analysis (Bizze, 2018: 31)

Organizational Engagement

Private social media activities of employees not only contain risks but also opportunities for the company. Because a company or brand is presented through private social media posts of employees as well as the posts of official social media pages. Employees mostly are free to share brand or industry related posts or comments according to policies of the corporate companies. But the context should be consistent with brand value. Some of companies -such as: L'oreal, cosmetic company; Patagonia Inc., outdoor clothing and gear company; Societe Generale, financial service company and; Pernod Ricard, wine producer- expect their employees become a 'brand ambassador' in order to reflect organizational culture and attract customer or job candidates. But researches show that many employees, especially younger ones don't follow their companies at Facebook, Twitter, LinkedIn or Instagram. Companies tend to evaluate that situation as a lack of organizational engagement (Cervellon & Lirio, 2017).

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Intrinsic Work Motivation and Proactive Work Behavior

Bizzi claimed that 'if the job of individuals requires high formal interactions, the relationship between social media use and blogging with coworkers is stronger'. He also indicated that blogging with outsiders (individuals who do not work for the organization) negatively related to intrinsic work motivation and proactive work behavior. But blogging with coworkers positively related to intrinsic work motivation and proactive work behavior. (Bizzi, 2017: 1-28)

Social Capital and Organizational Identification

Sias and Duncan (2018) found a positive correlation between the level of employee interaction with their company's Facebook page and, organizational identification level of employees. Also they indicated there is a partially mediated effect of social capital outcomes on the relationship between employee – company Facebook page interaction and organizational identification. As an overall result, writers suggested that social media activities of company are enhancing employee organization relationship by improving social capital and organizational identification among employees (Sias & Duncan, 2018).

Social Media and Business Performance

Paniagua and Sapena (2014) conduct a research to test the effect of social media usage on business performance. Results show that 'followers' and 'likes' affect business performance (stock prices of publicly traded companies) positively. This effect occur only after the social media account reach a critical mass of followers. Authors also claimed that Twitter is a more powerful tool to enhance business performance than Facebook. (Paniagua & Sapena, 2014)

As it is described in Daimler case, the CEO's scandal went viral on social media and in a short time that had affected the company negatively. Share prices of Daimler dropped by approximately 5 euros in 10 days despite the positive atmosphere in automobile industry.

In April 2017, United Airlines one of the biggest airlines in the world, found itself in a scandal. On the day of incident, the airline company realized that they overbooked the flight and needed four passengers to leave the plane. The company offered 800 dollars as compensation. Finding no takers however, the company decided to chose four passengers randomly to disembark. When one of the four passengers refused to leave the plane, an officer dragged him out of the plane by using force and left him bruised and bloodied. Comments and videos by other passengers on the plane went viral on social media draw attention all around the world. The passenger, David Dao, who is Chinese, claimed that his ethnicity made him the target. Within 48 hours, United Airlines' stock dropped an estimated 255 million dollars in market value. The company experienced a dramatic drop in its reputation. One of the largest investors of the company, Warren Bufett, stated that the company had made a suicidal mistake in managing the incident.

Culnan et al estimated social media as a tool to create 'virtual customer environment' which, shapes the common interests of the customers virtually. In order to gain value by virtual customer environment organizations need to incorporate community engagement (Culnan & Zubillaga, 2010). As stated in the Pepsi example above, instead of using traditional media tools such as advertising on Super Bowl, the company prefers to focus on virtual customer environment. As a result of focusing on Pepsi Refresh

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Project, the company created a strong community engagement with thousands of Twitter followers and millions of Facebook friends were added in a short time.

CONCLUSION

As it was argued by examples and empirical findings, communication with stakeholders via social media could benefit to all functions (marketing, operations, finance, human resources, research and development, corporate communication etc.). Some of those benefits we can summarize in this chapter are:

- The development of social media completely changed the way companies communicate with their employees and customers. There is a clear transition from traditional media channels to social media.
- Firms want to increase sales by using agents on social networks for viral marketing, brand communities, ads in social networks that can direct the
- Social media is also a tool, which, facilitates creation of value and improve work performance. It has been stated that using popular social media platforms or enterprise social media platforms affect emotions and job attitudes, employee creativity, workplace integration, effective knowledge management system, consumer relations and reputations.

But researches also pointed out some negative impact or risks of both internal and external social media usage. As the contents in social media that reach masses around the world, social media can create an environment that encourages the individuals to generate bad publicity as well as good publicity freely. There is a discussion among professionals and scientists about the negative and positive aspects of social media usage and, researchers suggest formal guides and clearly stated policies about social media usage in order to maintain the benefits.

Social media is a cultural shift, not an operational one so the emergence of social media has created a new normal for the organizational and marketing communications with all the stakeholders. In the future, with the integration of the digital tools like wearable technologies and human body, social media communication and contents will evolve in many different forms and become the new normal. In terms of management, businesses need to re-decide on the formal and informal forms of communication and what arrangements they will make. On the other hand, from the marketing perspective, the importance of developing new marketing strategies and methods to make the most effective use of these new communication channels should be investigated.

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KEY TERMS AND DEFINITIONS

Social Media: Social media is defined as any web site including user generated content. With social networking sites (Facebook, Myspace), creativity works sharing sites (YouTube, Instagram, Soundcloud), business networking sites (LinkedIn), collaborative websites (Wikipedia), commerce communities (eBay, Amazon), podcasts and open source software communities (Linux, R), social media can take many forms.

Social Media Marketing: Represents use of all social networks for marketing, creating value, public relations, and customer relationship management.

Enterprise Social Media: Web-based platforms used inside an organization to support internal interactions within employees. Most of the enterprise social media platforms allow users to send messages to coworkers, indicate the work team, post, edit and sort common shared work files, opening chat rooms, or social groups, etc.

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Chapter 8
Can Internal Social Media and Data Mining Be a Powerful Communication Vehicle in Reaching Employees in Change Management in Industry 4.0?

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ABSTRACT

With the rapid changes in the information and communication technologies through Industry 4.0, managers and change agents are now able to unlock wholly new streams in communicating change to their stakeholders. Social media can be an important "vehicle" to facilitate better and faster change management, whereas data mining can provide some crucial insight about employee perception about change. The purpose of this chapter is to capture the reader's attention towards the relationship between change management and Industry 4.0 tools specifically: social media and data mining. For that purpose, three in-depth interviews with senior managers of a Turkish telecommunication and technology services provider were conducted. The results support the research questions partially but point out new variables (national culture and generation gap) to consider in the relationship between employee behaviors and social media usage as an internal communication tool. Lastly, this chapter aims to provide suggestions for further studies.

INTRODUCTION

The business landscape of the 21st century is characterized by ever changing trends and events that happen with so much rapidity that they take most business leaders by surprise. Five decades ago, futurist Alvin Toffler (1970, 1) said "The acceleration of change in our time is… an element force". Today, Argyris (2004) and Ruben (2005) and many other scholars agree that change has become a ubiquitous

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staple in organizational life and will likely remain as such beyond our time. With this mind, if anything has remained constant in the history of organizations, it has been the change.

The first decade of the new millennium has been forecasted to be a period of tremendous change in the workplace (Gordon et al., 2000). The structure, content, and process of work have changed drastically. Knowing how to adapt and change successfully has become a critical and timeless challenge for all organization (Feldman, 2004; Piderit, 2000) and an interesting subject for many scholars to explore. After numerous articles, papers and books; professionals and consultants reports have been published about organizational change after one another, several approaches to how organizations should plan, implement, and manage the change process were introduced, experimented and theorized. However, we are in a new era- Fourth Industrial Revolution- commonly known, as Industry 4.0- the evolution to new business models, processes and techniques. It appears to be changing the way organizations function. Fourth Industrial Revolution is based on the development of a completely automated and intelligent production, capable of communicating autonomously with the main corporate players. At the same time, obviously, Industry 4.0 has become a new theme for management scholars and business economics disciplines (Piccarozzi, Aquilani & Gatti, 2018).

Industry 4.0 means change- change for societies, industries and organizations. Change is everywhere and in everything. Industry 4.0 will likely change how we think, how we produce, how we interact in the organizations, how we manage our workforce, and many more. As Harold Goddijn, CEO of TomTom NV said, "*It's just mind-boggling what has been achieved in the past 10 years. The speed by which things are changing is increasing at astonishing rates, product cycles are much shorter, innovation is happening faster, and it is very challenging for the C-suite, as well as the employees, to keep up with the pace." (Deloitte, 2018).*

One of the biggest changes Industry 4.0 brought in this century has been in communication. The process of corporate communication has evolved over the years, with many path-breaking inventions that lift organizations from one level to another. Researchers state that the initiative of Industry 4.0 approach is expected to have influences on corporate communication, as it comprises communication systems and tools by network systems and will change internal communication (Valik, 2013). Industry 4.0 builds and extends the impact of digitization in new and unanticipated ways into organizations, represents entirely new ways in operations and management, and creates opportunities to run businesses better, faster, and more cost effectively. The recent trends in IT such as cloud computing, data mining, connectivity and multimedia networks have big impact on organizations' effectiveness. Understanding these trends from change management perspective can be critical and if not necessary, because communication and organizational change are interdependent. There has been a unanimous agreement among organizational researchers that effective communication is the crucial and key component of a change process (DiFonzo & Bordia, 1998; Lewis & Seibold, 1998). Communication provides clarity, direction and enforces commitment to change. On the other hand, poorly managed change communication or lack thereof results in not only rumors, resistance to change, and exaggerating the negative aspects of the change (DiFonzo et al., 1994; Smelzer & Zener, 1992), but also causes the failure of organizational change initiatives (Coulson-Thomas, 1998).

The continuous improvements in IT in Industry 4.0 provides managers and change agents more alternative modern forms of communication in reaching their stakeholders during change. One example can be the sudden rise of Social media usage. As Clayton (2015) explained the value of Social media in change management in his study *"Because we spend nearly three hours per day on social platforms,*

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and because more than half of employers are already using internal Social media, companies also have an opportunity to leverage Social media as a change management tool." Major benefits can be listed as providing the latest information to the employees in a timely manner and building greater internal loyalty by actively soliciting continuous feedback on issues related to the change. Additionally, Social media storytelling can be a powerful tool when management wants to drive change by lowering the fear and uncertainty and inspiring confidence at the same time by persuasion that is, to combine the change concept with a positive emotion.

Established technologies like Internet of Things, Cloud or Big Data are propagated solution components of Industry 4.0 (Gölzer, Cato & Amberg, 2015). The use of data mining as an analytical tool in management has been increasing in recent years. In addition to traditional Human Resource data sets, companies can now collect so much more data- scanning Social media data, for instance or analyzing the content of emails to gauge employee sentiments (Marr, 2018). Especially, in change management, it can be extremely useful and strategically important to provide a mechanism to uncover potential paths of employee resistance to change through data mining. Information received from data analysis can be a critical success for managers wishing to solve issues related to resistance to change in their organization, as it creates competitive advantage by giving them new ways to understand, evaluate and manage the resistance and opportunity to plan their change strategy to address these factors. This is critically important, especially when change management literature identifies resistance to change as one major factor for change failure.

Despite its popularity, the impact of Industry 4.0 on corporate communication has not yet been investigated enough and there is a significant gap of research exists in literature. Also, with more and more people joining Social media sites and using them regularly and efficiently, while companies have been obsessing about how to use digital to improve their business, the application of digital tools to promote and accelerate internal change has received far less scrutiny. This chapter aims to contribute the literature by providing some solid research findings on the impact of Industry 4.0 tools on internal communication during a change process. The main goal of this chapter is to investigate if Social media and data mining can be used effectively as a communication vehicle to reach the employees in change management and provide some recommendation.

This chapter is both important and timely. Today, organizations devote extensive resources and efforts to organizational change; however, in many cases, organizational changes have failed to deliver expected results and/or meet intended objectives on time. The key to successful implementation of the change lies in effective communication. Effective communication is not only information sharing, participation, compliance, and feedback, but also increasing the employee readiness for change, maximizing support and enthusiasm of employees while minimizing misfit, aggression and complacency caused by miscommunication during change process. Adding new communication tools together with traditional ones and turning the data into knowledge such as predicting employee behaviors and attitudes during change on the goal of adding value and increasing employee engagement to the process will only help the change teams and leaders to reach these goals more efficiently and effectively. While both change management and data analytics have received considerable attention from scholars and practitioners as singular fields, the research on the intersection of the two has been still insufficient. It seems that we are only at a very early stage of the fourth industrial revolution and that we do not fully understand what its effects on the organizations and employees might be; therefore, any research in this field will be more valuable asset than ever before for managers, researchers and practitioners. Additionally, the less studied

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employment of Social media and digital storytelling for internal communication in change management can be a good avenue for an academic research, as it develops an understanding how technology enables or constrains communicational activities that constitute main channels for workflow (Leonardi et al., 2013, 2). Finally, a positive consequence of this chapter is the source it can provide for future research.

BACKGROUND

Organizational Change

Change is one of the most studied topics in organization theory and management (Cunha & Cunha, 2003). Change is challenging in nature. When the definition of change is described traditionally as 'moving from a current state to a desired future state for better', it sounds simple, if not easy to manage. However, when certain adjectives such as vital, risky, unavoidable, inevitable, confusing, etc. are placed in the same sentence to characterize an organizational change, it clearly points out that organizational change indeed can be complex, and rigorous and in most cases, may also very difficult to lead.

Organizational change is defined as the process of continually renewing an organization's direction, structure and capabilities and modifying the business strategy, policies and practices to serve the ever-changing needs of external and internal business environment (Moran & Brightman, 2011) in order to achieve long-term sustainability and overall organizational effectiveness.

Social, economic, and technological forces have dominated the business world for decades, turning 2000s to an era of change. Since then, organizational change management and transformation have become permanent features of the business landscape (Aguirre & Alpern, 2014), and maybe the only way to stay "in the game"- demonstrating high performance improvement of business operations and making the company competitive in a turbulent global market. The successful management of change is accepted as a necessity in order to survive and succeed in today's highly competitive and continuously evolving environment (Luecke, 2003; Okumus & Hemmington, 1998).

Change is faster than ever. In a radically shifting landscape, traditional methods of change management need to be upgraded with new tools and methods. Businesses are already living in 'Industry 4.0' and those businesses that survive and thrive will be those that embrace change now (Ismail, 2017). Industry 4.0 is based on the development of a completely automated and intelligent production, capable of communicating autonomously with the main corporate players (Piccarozzi, Aquilani & Gatti, 2018). Organizations are on the cusp of revolutionary changes in computing architectures, manufacturing and how they power the economy (Satell, 2018). Yet today, managers and leaders have a perfect recipe for this constant change- Being fast and agile. The organization itself is being forced to be fast and change to adapt to new ways of getting work done including distance work, telecommuting, virtual teams and many other changes (Petty, 2017).

Communication in Organizational Change

In the organizations, effective communication is critically important, as it has a vital role in the failure or accomplishment of any organization (Orpen, 1997), as it is connecting the employees in order to reach mutual goals and develop and sustain a competitive advantage for organizational performance and improvement (Rowe, 2001).

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In change management, communication is the heart of the transformation process. The importance of communication during a change process has been discussed by many authors, such as Kotter and Schlesinger (1979), and has been empirically demonstrated and commonly agreed among practitioners. The results are clear; these two terms are inextricably related processes (Lewis, 1999), and the bottom line is that communication plays a critical role to decide the fate of the changes. It has also been shown that ineffective internal communication is a major contributor to the failure of change initiatives (Coulson-Thomas, 1998).

Communicating change is more than explaining the employees why and how the organization must change. It is to prepare them for the entire experience by making them a part of the process since day one, empowering them to commit and engage change, and last, but not least making them feel secured by minimizing rumors before they spread throughout the whole organization.

Communication in change has multi-faceted role. Lewis (2011) explains that the employees try to make sense of the change process by discussing its imperatives among themselves. This communication decides whether they are going to support, resist or alter the change process at an individual or collective level. It is just as important to recognize that if employees choose to resist, they become the main obstacle in the process-it means delays, costs and conflict in the progress, mostly leading to dysfunctional behavior such as lack of motivation, decrements in performance, and more. There are many reasons why employees resist, but in most cases, they are generally fall to a company's internal communications systems and processes- lack of communication, poor communication, inconsistent communication or ineffective communication. Briefly, a failure not to have a strong change communication plan in place is the reason for change crumble, on the other end, when done correctly; communication is not only the top driver for success, but also the key to manage employee resistance.

Anatomy of a Communication Plan in Change Management

Change for an organization means change for the people in it (Zener, 1991). From this perspective, effectively managing change in the context of audience (employees) is strategically important to improve the relationship with employees and gain their support for the change. The skeleton of a communication plan is about choosing the right person or group of people to be responsible for communication, analyzing the stakeholders' interests, designing the message (customizing it to the needs and interests of each stakeholder group-target specific), choosing the right channel and getting the feedback, making sure the communication is fluent, consistent, on time, credible and comprehensive, and monitoring/evaluating communication effectiveness to ensure the goals are achieved. Change teams should be aware of that employees understand and interpret messages differently and therefore, use a variety of communication means.

When internal communication takes place, the main focus should be on understanding the employee emotions. That is the key for being the winner in change process. Emotional reactions to change are a normal reaction to the real and perceived disruption that accompanies organizational change. Successful change leaders know that understanding and addressing the mixed emotions that employees may experience can help employees feel motivated and committed to achieving their goals, implementing change, and realizing a new vision for the organization (Sikerbol, 2015). Additionally, employees' moods and emotions can influence a variety of critical performance related outcomes including judgements, problem solving and motivation (Totterdell & Nevil, 2014).

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Emotions can be analyzed in two different ways. Firstly, change always trigger a variety of emotions in its recipients; therefore, it is utmost important that the change message is communicated in a way that best reaches the target audience (Cameron & Green, 2004). For example, when a change is first announced, employees often react with denial, feel insecure and fear; as familiar status-quo is about to change. The aim of the communication is to provide "knowledge" by giving accurate, detailed information about change- bias free (no filtering, no overloading and no politically correct information), on time, by the right person, consistently. The message should emphasize, "We are together in this journey". The richest channel in most cases for this stage is the face-to-face meeting. It is recommended that face-to-face communication is one of the best way for sending in difficult or complex messages (Myers, Hulks & Wiggins, 2012). During post communications, for announcements and updates other channels such as intranet homepages and online forums can be used. Secondly, depending on their moods and emotions, employees may understand and interpret messages differently. Choosing proper words, expressions and body language will help managers and change teams to reach their audience in an effective and meaningful way-build connection. It is not about how managers feel, but the employees- they are the recipients. Leaders and change team members need to control their own emotions, empathize and help employees to move along the path to change.

The Impact of Technology on Change Communication

Information and communications technologies develop notoriously fast in this era, providing innovative and exciting new ways to reach employees in organizations. Based on Hauer, Harte and Kacemi (2018) recent study findings showed that the transformation towards a paperless-workplace is supported by new communication tools e.g. networked platforms as they might be used as an internal sharing-place of information and documents. These new vehicles can be a great asset in communicating change, because organizations need to establish fast, interactive, and reliable channels to reach all employees. It enables managers and change agents to get employees engaged in the change program and to improve their collaboration (Myers, Hulks & Wiggins, 2012).

Social Media

The presence of powerful communication technology like the Social media has indeed changed the way people communicate and presents perfect resource tool for change management. In today's world, the impact of Social media as a part of that process cannot be overlooked, given its integration into people's lives. Social media adoption in internal communication has been investigated and recent study stated that there are at least two properties of Social media tools that make them distinct from other communication media commonly used in companies: first, they enable visibility into communicative patterns of the colleagues and other stakeholders and make these visible traces being persistent over time, what means that information will remain accessible in the original format (Treem & Leonardi, 2013).

The importance of Social media in business is growing at warp speed. Managers and change team seeking to drive change and improvement have a lot to learn from the Social media. This is because when it comes to mechanism that helps to facilitate change, Social media platforms are the ideal platforms since much of change management boils down to on-going conversations and dialogue among employees (Rick, 2010).

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Main functions of Social media in change management are sharing information to larger audience, motivating employees, increasing employee engagement and managing resistance. Change is complex and frustrating in nature. Employees need to be inspired to move. Social networks can help flatten the organization and ensure that the change does not feel "top-down." Employees feel ownership over the change. There are many benefits of using Social media as a communication tool during change process. Mainly, it allows information circulated in multiple directions, creates a collaborative, inclusive and supportive environment that employees feel involved and provide feedback freely, and finally drives transparent dialogue. Furthermore, in the absence of sufficient explanations, there will rumors. Social media can be a perfect tool for combating them as it has an ability to disseminate information broadly in large organizations. By deploying Social media channels as part of communication plan, managers can showcase progress, connect early adopters across the organization with each other, cite examples of how change is being embraced at various levels, and recognize and applause efforts. There are few things as impactful as good examples and it is an effective way to remove barriers and resistance (Fouche, 2016).

There have been some studies conducted to understand the application of Social media on change projects. Based on the findings on the use of Social media from Prosci's 2012 edition of

Best Practices in Change Management, almost one in five participants reported that they utilized Web 2.0 or social networking tools and used social networks for internal group information sharing and discussion media. A third benefit identified by participants was the availability of informal feedback and monitoring of staff's perceptions regarding the change. This ability helped to identify and manage resistance or potential resistance and solve misconceptions or problems early on in change process (Creasey, 2018). A study by Weber Shandwick and KRC Research, 55 percent of employees said they wished their employer had communicated more over social and digital media during times of change (Borysenko, 2016).

Using Social media in change management will be more common eventually, but more importantly it might be one of two options in communicating change soon in work environment, as the workforce demographics are changing to be digital oriented and tech-obsessed. A new generation is emerging in workplace- "Generation Z- iGens" who were born and grew up in the digital age, compared to millennials. Generation Z is a group characterized by smartphones and Social media. Like millennials, generation Z share constant connectedness, but this generation of digital natives is also fiercely independent about their digital decision-making (Schneider, 2016). They have less time for office politics, and they demand increased collaboration, transparency, and feedback. They can adapt quickly and are learners by nature. They communicate through media. As a result, when it comes to communication, Generation Z will choose the most effective method at workplace.

Digital Storytelling

There is not one type or one size of change, but many, as every change needs to be customized. Digital storytelling can be a powerful communication tool to personalized change for employees and liberates innovation, by generating the energy needed to change. Stories are key to creating and sustaining organizational change, because it helps leaders to motivate, engage and inspire employees during the change process. Leader cannot eliminate fear, abolish uncertainty or avoid the prospect of change for the organization, but they can leverage these emotional navigational stakes to the greatest advantage by telling a purposeful story (Rick, 2011).

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Storytelling can be a powerful tool when leaders want to drive organizational change. Research on memory conclusively shows that all the critical details, data, and analytics, are more effectively emotionalized and metabolized by the employees when they're embedded in a story – and they become significantly more actionable. Basically, a story is a vehicle that puts facts into an emotional context. (Rick, 2011).

In her book, Parkin (2010) explains the rationale behind the use of storytelling for managing change and explores five specific aspects of change: dealing with change; being creative; helping leaders and teams go through change; dealing with the stress of change and developing emotional intelligence. With the advent of digital and Social media tools, many have found new outlets in online communities to share their stories and experiences about change. Digital storytelling can be critical in communicating the change, as stories create an emotional connection. Research on memory conclusively shows that all the critical details, data, and analytics, are more effectively emotionalized and metabolized by the listener when they are embedded in a story and they become significantly more actionable. The commitment to change a behavior requires a willingness to expend effort to change that behavior. Finding out about other people who have succeeded at behavior change can be an inspiration both to make that commitment and to follow through on it (Leeman, 2018). Through digital storytelling, employees can share, reflect upon, map-out, transform, and re-story their authentic relationships with change. Change-stories express an interpretation of how and why the organization is changing including a genuine relationship with change and serve as an object for critical reflection and reflective dialogue that may result in a revised change-story (Brendel & Chou, 2016).

Data-driven Approach to Change Management

The use of data-mining as an analytical tool has been increasing in organizations in recent years; and the emergence of new management and marketing paradigms such as the Industry 4.0 initiative have led many organizations to look at utilizing these powerful techniques; however, practical applications are still in their infancy, especially in human resources due to ethics or legislation. A data mining process in HR aims to improve the probability of predicting employee behaviors by comparing them with a purely random 'guess' (Marritt, 2011). The goal of HR data is to improve decisions, make employees happier, and optimize processes; therefore, it adds value to the organizations. Data-driven HR focuses on recruitment, career progression, performance, productivity, absenteeism, employee satisfaction (Marr, 2018).

There are many concrete ways HR data and people analytics can support change management; engagement data can help identify likely resistance, the new generation of real-time employee sentiment tools can help assist in the implementation phase, network models can identify useful change agents/ambassadors, evaluation of effectiveness of training classes, predictive models for adoption usage, effective dashboards for usage of the new solution and many more (Andersen, 2018).

In today's highly competitive business environment, change management needs more data or specific data to assess risks, progress, adoption and usage. Recently, p*eople analytics* — defined as the use of data about human behavior, relationships and traits to make business decisions became strategically important in change management. As change management goes broader and deeper; it requires various areas of expertise and its own specific set of tools and took its share from data science. A new concept emerged: *change analytics*. Change analytics is a nascent line of research that examines the impact of incorporating intelligent data into the management of organizational change (Geller & Mazor, 2011). Change analytics serve as a principal approach to identifying resistance hotspots, understanding where

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exactly to make change interventions, and to align leadership with the most pressing implementation challenges (Stenius, 2017).

Data mining is becoming a reality for change management, and although it may not have fully arrived yet, it is time for organizations to get ready. For example, employees' comment on Social media about changes a company is making give potentially vital insight into how they are responding. With new data analytics tools, change managers can now capture clues about behavior from employees' word choice; even the use of articles and pronouns can help reveal how an employee feels. Applying these tools to anonymized company email or the dialogue on tools like waggl.com will give fresh insight into change readiness and the reactions of employees to different initiatives. Insights from analyzing internal communication will be a great source in leading employees (Tushman et al., 2017). Another example is that if psychometric and personality-testing results analyzed through data-driven methods, this will allow leaders to optimize their employee resources for change process such as selecting candidates with high openness to change score for change agent positions in upcoming change projects.

Intelligent change data before, during, and after implementation is fundamental to identifying resistance hotspots, understanding where exactly to make change investments, and to help maintain strong leadership alignment around where the implementation challenges are and what to do about them (Deloitte, 2018).

METHODOLOGICAL FRAMEWORK

Purpose & Research Question

The purpose of this chapter was to explore the managers perceptions regarding the role of Social media and data analytics as a communication tool in change management. Formally, the intent was to answer the following research questions:

- *How can Social media be used to reach employees during an organizational change?*
- *How do employees feel about Social media as a tool of receiving information and sharing their feedback about change with their managers or colleagues?*
- *How can digital storytelling be used to reach employees during an organizational change?*
- *Has been any data analyzing in the organization about employee perception of change, resistance to change or similar attitudes about change?*

Research Design: Qualitative Study

This study was conducted based on a qualitative research approach. The primary form of collecting data was through in-depth interviews. To obtain optimal results of the interviews, this study used a semi-structured interview approach. The main selection criteria for the interviewees was to be expert in both change management and data mining with an experience of at least 5 years in senior management position. The three interviewees were aged between 37 and 45, either computer or electronic engineers, and have intensive experience in coding. All three senior managers have led their teams in various type and size of changes in the organization. Participants work in a one of the biggest telecommunications and technology services provider, which was founded and headquartered in Turkey. With more than 5,000

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employees, offering a wide range of innovative products and services, the company not only operates in the region, but also has investments abroad.

To address anonymity and confidentiality issues, an interview participation consent letter was provided. The letter consisted of an explanation about the research, guarantee of confidentiality and anonymity. The face-to-face interviews were conducted and recorded in November 2018, lasted for 30-40 minutes. The interviewee's names, titles, and company name were not disclosed in this study for confidentiality.

Results

Senior managers explained how they communicate change process in their organization by answering questions below:

Question 1: Can you describe how communicating takes place in a change process for large-scale transformation in your organization?

"When we talk about large-scale organizational change, they are million-dollar cross-functional business processes. In most cases, the power of planning and decision making are exclusively in the hands of top management in the process. The communication is top to bottom. Written communication plays an important role as well as oral communication. Among senior managers, face-to-face meetings are the first and mostly used medium. This gives us an opportunity to brainstorm and discuss the details. We also use intranet effectively. Senior managers have 3-4 teams under their supervision; each team has a leader who is responsible for circulating the information to and collecting the feedback from his/her team members. After change is finalized, we use posters and boards to market the change to our employees."

Question 2: Which channels are used in change communication with subordinates?

"Emails and intranet are very common. Peer-to-peer communication is preferable. Colleagues find it useful to verify the accuracy of the information they already have. Face to face with the team-leader and employee-meetings with top management are the formal channels in change management we use. The frequency of formal channels is lower than others, but the efficiency is higher, as it builds trust and confidence."

Question 3: Do you think Social media can be a useful tool to reach employees in your organization? Why?

"No. we do not think so. It is too generic and lack value. Information sharing on Social media is very self-promotional in nature. In most cases, it is too broad, not specific. In our organization, our colleagues prefer personal interactions. It is understandable, as changes of this magnitude we manage abrogate our employees' psychological contracts with the organization causing them to experience anxiety, stress, and insecurity. Also, rumors threat our employees' sense of control."

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Question 4: Have you ever used Social media as a communication vehicle or if not, do you consider using it in change process eventually?

"No, we have not. Unfortunately, we cannot use Social media as a communication tool, because of confidentiality issues related to our changes. Especially, the leakage of information during planning stage is a significant concern for C-level executives. Once, we used Social media to collect feedback on a project (which can be considered as a developmental change), unfortunately, we were not successful. Our employees resist providing feedback through Social media. The common and arguably natural reaction of many employees are the need to hide their emotions, more importantly if they have negative feedback, they have concerns or some level of fear of being labeled as a resistor."

Question 5: Based on your experience, where do your subordinates prefer to get their information about organization change?

"Young subordinates definitely prefer Social media; the reason is simple. Generally, meeting means formality for Millennials, Social media gives them freedom, mobility and flexibility. On the other hand, older generation's choice- mostly Generation X's will be face-to-face meetings, as we still value classic work models. We believe for Generation Z, it will be even one step ahead; the content of work activity is detached from space and time. To reach organizational goals, the place of work will be irrelevant for them."

Question 6: What are the main reasons for these personal preferences?

"One thing is clear; they show a far stronger tendency than their older peers towards using Social media. Being on Social media is a routine activity for them. It is fast and less time consuming, they access information whenever and wherever they like. However, a notable concentration of high-ranking professionals aims for quality over quantity; we prefer more personal touch and privacy."

Question 7: Do you use digital storytelling?

"We use story telling in promoting product and service, mostly for digital marketing. Additionally, we find it very useful in social responsibility projects."

Question 8: Do you think digital storytelling will be useful in change management?

"Definitely in the final stage. After the completion of a transformational change process, it will be very useful to show the results- what have been achieved and create some positive feelings such as excitement and pride among employees. It can be a good communication tool to sustain organizational change and use that momentum to keep going."

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Question 9: What do you think about data mining in organizations?

"Data mining is crucially important in today's business environment. Analyzing large amounts of data is a necessity in telecommunications industry. It is indispensable part of management, if the organization not only aim to gain competitive advantage, but also stay ahead of their competitors and become a market leader, data mining is a must. It offers many benefits. For example, it accelerates innovation and idea generation, this is critically and strategically essential for us."

Question 10: Do you use data mining in your organization?

"Yes, we do. As we are in information and communication technology sector, we are very familiar with Artificial Intelligence, Data Science, Machine Learning, Deep Learning, Data warehousing, Business Intelligence, Data Monetization, Datamining, Big Data, and Data Modelling. We have analytics department. Data is our most valuable and important asset. We believe we should use date for our daily operations in every department and we should use our analytic culture to improve our operations and get better predictions. Mostly in marketing, sales, customer relationship, finance, network, HR and fraud management. In HR we use data analytics, especially in recruitment and performance evaluation. In our organization, we- engineers explore information, and combine it with existing knowledge to increase the novelty and diversity of proposed solutions."

Question 11: Do you think data mining about employees' perception of change process is useful for managers?

"Yes, it is. Simply because employees support is vital in change management, and predicting their intention is the key to win their hearts, data analysis provides us the input we need to understand employees better and build stronger relationships with them. Behavioral assessments through data mining is needed to make better employee related decisions in the organizations. During change, employees may have many questions. To find the right answers that will satisfy the employees will only be accessed by the right information."

Question 12: Do you use data mining in predicting employees' perception of change process in your organization?

"No, we do not. Before we can apply data mining algorithms, we need to build a target data set. Unfortunately, as today, we do not have available data."

Question 13: What do you see as the future of change management, especially regarding the use of technology and/or analytics?

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"So far, we know that the scale of change is enormous. As technological advancements continue in this pace, artificial intelligence's role in our business world will only grow bigger and become more significant. Today, leaders are facing a future where all these technological advancements will challenge the foundations of what, how, where and when organizations operate, meaning that organizations will transform themselves without any input from employees. Big data will be an unavoidable part of organizational change from now on. First and most importantly, corporate AI will define the need for change. Next, emotion AI through face recognition will evaluate the employee reaction to change and measure the success / failure of the change."

During interview, interviewees shared their own personal thoughts about Social media usage in internal communication in the organizations. Based on their experiences and information received through their business networks, it is not common to use Social media for sharing information about change in the organizations in Turkey. The main reasons they identified were; a) Social media has not been accepted as a traditional internal communication vehicle in business yet- it is cultural; b) due to privacy, surveillance and data tracking issues, employees are cautious in Social media usage and c) temporary internet restrictions- shutdown of the messaging and Social media services had a negative impact on the employees' perceptions of Social media usage in the organization.

CONCLUSION

Using right communication vehicles in change management is critical and strategically important for the fast-congruent results. Beside traditional communication channels, Social media can be introduced as a safe, trustworthy space where employees can process the change and share experiences. Based on the considerable research, it is proven that organizations have witnessed the benefits of reaching their employees during change process by two-way conversation and change teams find these dialogues enormously effective. In this study, however, the results have not quite supported the previously conducted studies which are in favor of Social media usage in change management. This can be explained by two facts; the content of the information and national culture.

The main factors to be considered while selecting the means of communication are the content and importance level of the information. One recent study result regarding preference between social and traditional media tools in specific situations showed that young employees prefer email newsletters, intranet news and face-to-face meetings when they deal with strategic information. Notably, Social media is the most favorable tool for employee-to-employee communication, while for discussions with managers, meetings are preferable. In general, respondents showed unexpectedly high preference to traditional media for internal communication over Social media. The results of the survey are consistent with another large-scale research on the topic by European Communication Monitor (Zerfass et al., 2010), and suggest that Social media impact on internal communication is overestimated, and adoption of Social media in working settings develops more slowly than in private life.

One of the contributions of this study can be that it highlights the impact of national culture on communication channel preferences. Each culture has its own learning and communication process (Wan Lee, Becker & Nobre, 2012). Deciding one medium being a better option than another is based on an individual's values, which can also be influenced by the culture of the interactant (Schwartz, 1994).

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Extensive literature review proves that the usage of Social media in internal communication varies across cultures and also cultural dimensions can interfere or facilitate the diffusion of information (e.g. Khan & Ahmed, 2017; Waters & Lo, 2012; Gravili, 2016; Hofmann, 2018). For example, there is significant difference between high and low context culture on choice of communication media (Yang, 2016). Turkey has been in the center of many researches in this field due to its unique characteristics of high context nature. Based on Hofstede's culture context theory, Turkey would prefer to use face-to-face communication, because Turkish communication is more than verbal expression; non-verbal is also crucial in Turkish communication (Hofstede, 1980). Moreover, power distance is another dimension that is closely related to Social media usage habits. Social media offers two-way, interactive, personal, and relational features allow top leaders to listen closely to employees and facilitate employee upward communication. Thus, the communication hierarchy within the organization is blurred, the power distance is shortened (Men, 2015). However, in the countries with high power distance such as Turkey, superiors are often inaccessible, employees expect to be told what to do, attitude towards managers is formal, communication is indirect, and the information flow is selective (Hofstede). Overall, Social media tools are found to be useful to complement traditional media, with a main purpose to facilitate expression of personal opinions of employees, and knowledge sharing.

Digital storytelling has emerged over the last few years as a powerful communication tool in change management. However, until recently, little attention is given to the power of storytelling by change leaders. For organizations committed to continuous improvement, stories are key to creating employee engagement and sustaining organizational change and that should be emphasized. Leaders should acknowledge the need for digital storytelling during change process and place it in their communication plan; because change practitioners and agents with conventional management backgrounds will use daily meetings, and use facts and figures, in return they can persuade employees, but they may not inspire them to act; to do that, they need to use storytelling to translate confusing and abstract numbers into compelling pictures of a leader's change goals and to boost their employee participation and motivation.

Considerable amount of evidence in literature suggests that big data is one of the most valuable sources for managers these days. Data mining is primarily used today by organizations with a strong employee focus on main HR responsibilities such as recruitment, performance appraisals and training. In addition to traditional HR data sets, companies can now collect so much more data and focus on other issues. For instance, a data-mining model to read and classify the employees' attitude about organizational change will be critically important for change leaders. As previous lessons highlighting the fact that while the impact of employees with positive mind can surely put an organization on the trajectory of success, or vice versa. Hence, understanding the minds of the employees during a change process is of paramount importance for initiating proactive steps to communicate effectively and efficiently. Although, a data mining model to read and classify employees' attitudes and feelings has not been implemented in this organization, the need and importance of is clearly recognized and appreciated. While both change management and data analytics have received considerable attention from scholars as singular fields, the research on the intersection of the two is considerably sparser, in practice it has not been common yet.

The digital workplace is a new way of thinking; it is the engagement of technologies and the way we work, communicate and socialize. Leaders and change managers should follow the new trends closely and implement social media and digital storytelling into their change communication strategies and use data mining to understand employees better during change. These efforts will internally improve the knowledge management and maintain healthier relationships with their employees. Finally, the workplace

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needs to change to accommodate the new comers- Gen Z who has a different expectations and habits to reach the information.

A word of caution…

Engaging with employees over Social media and data mining carries some risks and unintended consequences such as information security, legal context, ethics, privacy, inaccurate information reality delusion and misuse of information.

Research Limitations and Recommendations for Future Research

The research analysis was based on data collected from in total three interviews in one organization. This sample size proved to be sufficient to identify some consistent patterns, however, larger data set can provide more distinct regularities of emerging concepts. Since all participants reside in one country, it is acknowledged as a limitation. Further research can conduct a cross-cultural research to explore if there are variations in opinions on the subject across different countries. This would create another avenue for the future research with a focus on a cultural context.

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KEY TERMS AND DEFINITIONS

Change Analytics: The method of analytics that examines the impact of incorporating intelligent data into the management of organizational change.

Data Mining: The practice of examining large pre-existing databases in order to generate new information.

Digital Storytelling: The practice of using computer-based tools to tell stories.

Industry 4.0: A name given to the current trend of automation and data exchange in manufacturing technologies.

Internal Communication: The transmission of information between organizational members or parts of the organization.

Organizational Change: An ongoing process that results in many interactions between the human and non-human components of the organization to improve the organization for better fit with their external environment.

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People Analytics: The method of analytics that can help managers and executives make decisions about their employees or workforce.

Social Media: Websites and applications that enable users to create and share content or to participate in social networking.

Storytelling: The interactive art of using words and actions to reveal the elements and images of a story while encouraging the listener's imagination.

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Chapter 9
The Nature of Digital Leadership in Managing Employees Through Organizational Culture

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ABSTRACT

Thinking, decision-making, and visions have changed with digitalization, which transforms the climate and culture of the corporations and enables the emergence of new institutional behaviors and organizational environments. Should leaders and PR professionals change their current strategies to adapt themselves to the new digital environments? What strategies can the digital leaders utilize to connect with the employees of the future? One of the organizations that have been influenced the most by the digital transformation is the start-ups companies. The managers of the future will need all the flexibility, emotional intelligence, and creative thinking. Thus, the purpose of this study is to determine the influence of digital leadership on start-up companies regarding technological and social influences of the digital age across different demographics. Thus, a short questionnaire was implemented through semi-structured in-depth interviews in order to find out the influences over organizational culture. In this context, the leaders of eight start-up companies from Turkey were interviewed.

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INTRODUCTION

There is a strong relationship between the leadership of the digital age and the corporate culture that accords with it. Digital leaders have not only created blogs to communicate interactively with their thousands of employees but also use a more personalised and simplified communication language. In addition, they have introduced variety by recruiting people from different views, ages, sexes and socio-economic backgrounds. Many company owners have got closely acquainted with the digital world by appointing employees in their twenties even as their mentors. The impressions about the leaders who are supposed to be "insincere" have immediately been shared. This situation, in return, affected the management of corporate reputation. Through the advent of digitalisation, the modus operandi, ways of communication and new business models have created a new culture. Thus, digital culture has brought about new behaviours and habits in workplaces. Traditional corporate culture has led to the emergence of the traits and abilities indigenous to the leaders who can be successful by 2023. Hence, entrepreneurship, digital abilities, establishing powerful networks, requiring cooperation, having a strategic vision along with the ability to provide participatory loyalty are imperative for the new corporate culture. Corporate culture of the digital age encompasses having information about the others, bringing them together while giving importance to their requirements not as a group but as individuals and also enabling them to show their powerful aspects. In this sense, if leaders build their philosophy and culture on trust and open communication, they can bring the people around themselves together more easily and guide them through. Participatory loyalty, global management ability, creativity, trust, thinking fast, problem solving as well as digital abilities are *sine qua non* for the new corporate culture.

Hardly ever has there been such a startling transformation as in digitalization on an unprecedented scale in history. It is quite clear that as a consequence of enormous improvements in communication and information technologies, the world is rapidly getting more and more interconnected, which can simply be described by expanded versatility and on timely access to data. There seems to be practically no field which has, more or less, not been influenced by digitalization and leadership is no exception. In this digital era, companies have to face a new challenge as the progress to the new computerized organizations set down considerably more demanding requirements. It should be noted that thinking, decision-making and visions have changed with digitalization. Leaders now have a very important role in effectively internalizing this change in corporations. Digitalization also transforms the climate and culture of the corporations and gives way to the emergence of new institutional behaviours. Digitalization also transforms the climate and culture of the corporates and enables the emergence of new institutional behaviours. In this context, the institutional behaviours of the new generation employees are inevitably affected by this situation.

Much of the available literature on digital deals with the questions of the expectations and hopes of the new generation when they start working are and more importantly, if leaders and PR professionals should change their current strategies.

Despite the growing number of the new generation, talent supply does seem to meet the demand effectively. Especially in countries with low birth rates, the demand for Y generation is increasing. But what exactly is the difference between generation Y and others? What kind of communication techniques can be used to guide this generation? What strategies can the digital leaders utilize to connect with the employees of the future?

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The differences in generation Y are not only their predisposition to technology, but their behaviour also differs from the previous generations. This generation, whose thoughts are shaped by the impact of the global economic crisis, puts more emphasis on personal needs than the needs of the company. Members of the generation Y are not comfortable with stereotyped institutional structures and dislike the information silos. They want fast development, diverse and engaging career opportunities, and continuous feedback.

The new generation often demands a workplace where they can receive and encourage feedback in addition to having a flexible working schedule. They want to feel that their work is valuable and to see their labour being noticed. Companies that have succeeded in attracting talents from the new generation such as Google and Apple have become companies with naturally innovative perspectives that do not depend on how things were done before. Regardless of the long-term goals and desires of companies, the ability to attract and retain the talents of the new generation is one of the key points of achieving these goals.

Noteworthy, in this rapidly changing atmosphere, digital leaders should plan to administer development through an organized methodology to deal with the ICT Digital Transformation, which eventually is expected to ensure feasible long haul results. Considered to be at the centre of such advancement programs, individuals are expected to streamline internal assets while encouraging outer collaborations as well as utilize their own innovativeness and frames of mind.

New developments in communication technology have inevitably given way to a series of transformations in administrative and communicative structures. Hence, a new dimension with respect to the co-operation of virtual groups has emerged. It can clearly be perceived that information technology is consolidated in our day by day life. More specifically, technology and particularly data innovation is quickly progressing in the public and corporate arenas.

Herein, the concept of 'start-up' can be emphasized. A Start-up is a company, a partnership or temporary organization designed to search for a repeatable and scalable business model. Through the start-up phase, new ideas are brought to the market and transformed in economically sustainable enterprises. New firms are artefacts for transforming entrepreneurial judgment into profit (Spender 2014 qtd. in Spender, Corvello, Grimaldi, Rippa, 2017).

IT assumes control of employment and somewhat imposes corporations to change into new plans of action. In such an atmosphere, the need for digital leadership is increasingly critical. Therefore, it seems to be vital that the ramifications for arranging and working in a computerized society and the subsequent effects of this new situation on digital leadership be considered carefully and seriously.

The primary aim of the work is to draw attention to the influence of digital leadership on start-up companies with respect to technological and social influences of Digital Age across different demographics. Thus, a short questionnaire was implemented through semi-structured in-depth interviews in order to find out the influences over organisational culture. In this context, the leaders of 8 start-up companies from Turkey were interviewed and the results were analysed.

BACKGROUND

It is an undeniable fact that a new shape of management is rising, which requires the potential to comply with the response from the market, apprehend new opportunities, inspire the price-growing knowledge

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experts and orchestrate some of simultaneous activities. In recent years, there has been an increasing amount of literature on the aspects of a digital leader. In this study and in related studies it was observed that with the advent of digital leadership, there happened to be a considerable change in the direction of administrative pathways. Traditionally horizontal structure seems to have been evolved into a vertically flexible one. Abbatiello et al. (2017) argued that today, as at no other time, organizations do simply require progressively strong leaders, but need to create a new genre of more youthful, dexterous and digital-savvy, that is, "digital-ready" leaders. Now, leadership is less about the "art" of authority, but more about the difficulties that leaders are confronting. Most importantly, the sensational change of business is driven generally by the "switch to digital" (p. 83).

Effective leadership now involves a multidirectional flow of influence. Balser (2014) suggests that we should make a distinction between "line management leadership" and a broader sense of leadership, highlighting subtle and delicate variations. As defined by Balser, hierarchical nature of organizational leadership later past was centred more on 'position' than on 'process.'

New technical developments of communication have given way to unavoidable transformations in "management and communication structures, the meaning of ownership, increasing collaboration and virtual teams and new challenges for adequate communication" (Van Outvorst & De Waal, 2018, p. 466).

Digital leadership is supposed to protect the communications among technology, institutions and individuals so as to empower an organization or society to make ideal utilization of present-day communication technology and to keep away from its drawbacks "New companies are creating environments for coping with dissonant opinions, they create a basis for openness and trust as a basis for good decision making. Making them cope with the diversity and flexibility needed in this new world. All these have consequences for leadership in general, and digital leadership in particular" (pp. 466, 468). Furthermore, Wallin (2006), demonstrates that when value creation and learning are combined in activities, they are called "orchestrated activities" The role of the leader is to give the motivating forces and settings to profitable organized exercises to happen. Hence, four orchestrator roles can be defined: 1) conductor (information transmission and acquisition); 2) architect (problem-solving); 3) auctioneer (co-experiencing); and promoter (insight accumulation).

The respective concepts encompass the new situation that managers and leaders have to encounter, namely; "digital convergence, the knowledge society, value creation, the extended enterprise, learning, capability building, and leadership as orchestration" (p. xviii)**.**This type of management is about setting up trust, supporting imagination, building abilities, and afterward enabling flawlessness to happen. In Wallin's terms, leadership pertains to synthesizing all these aspects. Digital convergence has built up three basic conditions that give the premise to another type of rivalry: "pervasive computing, the extended enterprise, and the rise of virtual communities" (p. 37). As for utilizing digital technology, the method of reasoning appears to be quite different. Digital design provides flexibility and is likewise progressively adoptable to clients with various desires. Digital convergence has profoundly affected the creation of values and demanded a new set of qualifications (ibid. pp. 43-44).

Defining digital leadership as "a game of survival of the fittest," Brett (2018) introduces four key capacities that we should develop to be successful in digital leadership: "Tactical vs. Strategic and Delivery vs. Culture" (pp. 3, 10) As it were, we should have the capacity to react rapidly and give strategic answers for earnest circumstances and we should at the same time be key in our task. Inability to do both of these well restrains our odds of achievement. Similarly, we should assemble incredible conveyance abilities that help our organization's business display and grow a positive culture that draws in and holds the best ability.

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Additionally, Brett (2018) suggests that we initially define success before highlighting the most important capacities for digital leaders. For a digital leader, success should entail "building a motivated, high-performance capability that tactically and strategically delivers value to customers in sustainable way" Hence, digital leaders should be "tactical and strategic while focusing on delivery and culture" (p. 32).

The two axes, namely Tactical/Strategic and Delivery/Culture of the Digital Situational Leadership model leads to four modes of operation:

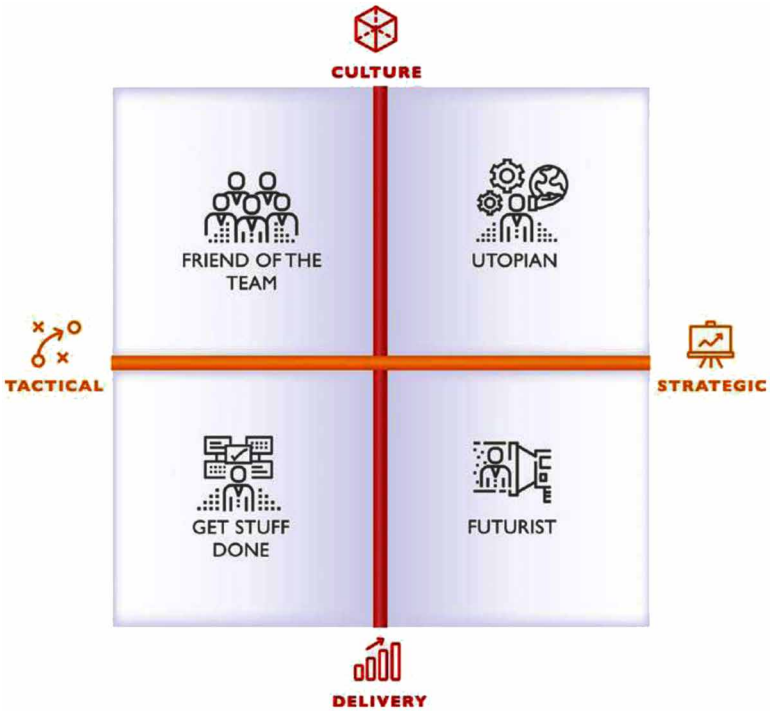
- Get Stuff Done
- Futurist
- Friend of the Team
- Utopian (pp. 34-35)

These four capacities are represented in the "Digital Situational Leadership" developed by Brett (p. 32) as shown in Figure 1.

Similarly, what success means in digital leadership is defined in four categories:

- From Personal Success to Team Success
- Finite to Infinite
- From Making the "Right" Decision to Making a Decision
- From Solutions to Problems

Figure 1.



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If an organization has not reached the digital level yet, Brett recommends an "evolution helix" which can be defined as a process for "developing our awareness with focus, effort, vulnerability, honesty, and self-compassion" This evolution helix encompasses four steps enabling progress in such an order: "Awareness, Intention, Attention, and Reflection" (p. 76).

Moreover, Bersin (2016) underlines those digital leaders make little exceptionally enabled groups. They trust these groups to perform, and they consider them responsible for client effect. They assemble continuous data frameworks to help basic leadership, and they anticipate that these groups should begin little, emphasize, test, and adjust. They take a gander at their business as stages, not similarly as items and administrations. Also, they structure the stage around frameworks that can be expanded, that can adjust, and that can convey ongoing data to supervisors at all dimensions. The key issue here is to be able to shape the organization according to the changes in business, which is called the "network of teams." (p. 4). With regard to digital leadership, another key factor emphasized by Bersin is culture as achievement is to a great extent subject to individuals imparting data to one another, joining forces, and ceaselessly instructing themselves.

According to 2017 Deloitte Global Human Capital Trends Survey, in order to achieve the transformation from organization "doing" digital things to one that is "becoming" digital, leadership is of critical importance. For both the organization and its leaders, this involves three different types of transformations:

- Cognitive transformation: Leaders need to think differently
- Behavioural transformation: Leaders need to act differently
- Emotional transformation: Leaders need to react differently (p. 80)

The findings of the respective survey demonstrate that the most basic requirement for most organizations is for leaders having digital capabilities. Figures reveal that just 5 percent of organizations feel they have solid digital leaders. In an indication of positive change, be that as it may, 72 percent of respondents are creating or beginning to grow new administration programs concentrated on advanced administration (p. 79).

In the same way, *2018 Deloitte Global Human Capital Trends* illustrates that 87 percent of the chief executives and heads of finance and information at the 10,000 most successful most successful companies in the world (C-level) officials have indicated that Industry 4.0—the industrial revolution realized by the mix of advanced and physical innovations—will prompt greater uniformity and stability, and 74 percent state business will have more impact than governments or different organizations to affect this future.

As the business environment becomes more competitive and digital disruption continues, organizations have become more team-centric, networked, and agile. While these approaches are taking hold in sales, operations, and other functional areas, a big problem remains: The C-suite must change as well. Rather than behave as independent C-level functional experts, the C-suite itself must now operate as a team. We call this trend the "symphonic C-suite," and our respondents viewed it as the most pressing human capital issue facing organizations today (p. 17).

In order to cope with extraordinarily quick natural and social transformations, equally sophisticated and versatile administration is inevitably required. According to Balser (2014) and El Sawy et al. (2016), even though there is no common consensus on the operational characteristics of leadership, there are six vital strategies that should be adopted in order to affect a successful digital strategy:

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1. A different kind of business strategy: Digital technologies are becoming fused into the very fabric of the business,
2. Different kinds of business models: An integrated digital business strategy and collaborative ecosystem platforms enable new digital business models for creating business value.
3. A different kind of enterprise platform integration: The upcoming era of adaptive and dynamically responsive digital platforms and accompanying organizational arrangements requires a new kind of platform integration.
4. A different kind of people mindset and skill set: Top management and all employees will need to be more adaptive and willing to experiment and innovate while occasionally failing.
5. A different kind of corporate IT function: The organizational changes required for digital leadership and a digital business strategy will require rethinking the roles of the corporate IT function and the CIO.
6. A different kind of workplace: As more "born digital" younger employees enter the workforce with different values, they will have different expectations of the workplace in terms of flexibility of location and working hours, sophistication of mobile online access, and the extent to which the work environment is "humanized" (pp. 142-143).

Having conducted an extensive research study on LEGO Company with respect to digital leadership, El Sawy et al. formulate the lessons pertaining to the strategic realization of digitalization and the requirements for digital leadership fewer than three headings as follows:

New ways of thinking about enterprise digitalization:

Lesson 1. Execute Business Strategy Digitally.
Lesson 2. Use Digitalization to Bolster Business Strategy around Your Core Distinctive Competence.
Lesson 3. Position the Corporate IT Function Close to the Business to Enable Responsive Digitalization.
Lesson 4. Create Multiple Digital Officers to Distribute Digital Innovation across the Enterprise.
Lesson 5. Leverage the Ecosystem of Partners for Complementary Digitalization Competencies.
Lesson 6. Iterate to Success in Digitalization;

New ways of thinking about platforms:

Lesson 7. Recognize that User Experience Drives IT Architecture, Not Vice Versa.
Lesson 8. Recognize that Dynamic Engagement Platforms for Digitalization Invert Business Priorities and Generate a New Level of Complexity.
Lesson 9. Collaborate with Technology Vendor Partners to Create Dynamic Digital Platforms.
Lesson 10. View SMAC (social, mobile, analytics, and cloud) Technologies through a Digitalization Value Lens.

New ways of thinking about the digital workforce:

Lesson 11. Hire Digital Generalists Rather than Just Technical Specialists.
Lesson 12. Create an Attractive Workplace for Digitally Savvy People.
Lesson 13. Improve and Monitor the Digital Quotient of the Workforce (p. 162).

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For the purpose of getting managers speed on troublesome technology Goodwin (2018) suggests offering digital leadership programmes, which enable officials to gain from the manner in which their clients use innovation and give them an opportunity to venture back and consider the ramifications of the innovation for their associations. Technology and especially information technology is rapidly advancing in society and organizations. Information technology is incorporated into our daily life. IT takes over jobs and facilitates or urges organizations to transform into new business models. The call for digital leadership is more and more urgent. What are the consequences of organizing and working in a digital society and what are the resulting impacts of this on digital leadership (p. 463). As portrayed by Bhanap (2015), a research associate at the *Leading Edge Forum*, the project conducted for the respective forum, namely *Digital leadership in the C-suite*, which incorporates interviews and surveys with C-level executives from a wide range of companies across industry sectors, has demonstrated that "less than 40% of companies believe their business leaders are equipped to harness and lead digitization. Most CIOs feel the digital agenda should be theirs by default, but in reality, fewer than 35% of today's CIOs are expected to be tasked with leading digital transformation" (p. 18). Bhanap has also asserted that CIOs should be viewed as powerful "digital business strategists" by their corporate fellows; if not, the digital role is likely out of their span.

Digital transformation is a long haul process that must be held onto by the organization, in general, to be effective. Eventually, an adjustment in an organization's advanced culture will affect the manner in which workers team up and how they draw in with clients and planned customers (Waghray, 2017). Hence, a good digital strategy ought to recognize the holes in an organization's innovation contributions and help figure out which advanced arrangements best fathom for their specific torment focuses.

Responses to the *Future of Jobs Survey* indicate that business leaders are aware of these looming challenges but have been slow to act decisively. However, 61% against 39% of respondents, companies that report recognizing future workforce planning as a priority are nearly 50% more likely to plan to invest in reskilling than companies who do not (The Future of Jobs Report 2018, p. 10)

Castello et al. (2018) argue that he computerized development venture requires to benefit from the encounters of a huge number of performing "actors," especially the individuals who are exceedingly had some expertise in vertical arrangements and who can quickly adjust to changes, similar to small organizations and new businesses (p. 107).

Arkhipova and Bozzoli (2018) portray that now chief information officers should combine their business insights with technical aptitude. Moreover, Arkhipova and Bozzoli also stress that becoming a true digital leader necessitates a much larger array of abilities and discernment along with the frames of mind to succeed. In fact, great leaders are the ones who can ask the accurate questions. In addition, they should in tandem with the most recent rising innovations and can recognize transitory promotion and the "game-changing "patterns.

Digital leaders are highly knowledgeable about the specifics of their business, their customers and their industry and hence are able to confirm if a particular digital initiative applies to their company or not. They are audacious enough to inject innovative tools and to disrupt the established routines but they are risk-conscious and do not expose their company's employees, data and customers to unnecessary security threats. Finally, true digital leaders understand the importance of people in making digital transformation happen (p. 144).

The CEO and a founding member of TIZE, Rana Gujiral (2016), explained how each company can adopt and implement a start-up culture:

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1. Entrepreneurial spirit should be adopted and cooperation should be increased.
2. To take the time to simplify the management hierarchy, to make plans, and to listen to the employees rather than manage them. Start-ups are small, that is, they do not have solid management structures like large companies. I'm not saying that you should completely eliminate the organizational scheme, but create an environment where ideas are expressed freely.
3. To stop searching for a rule book. You cannot take the start-up culture and apply it to a company just like that. Unlike established companies, start-ups do not follow an existing business model, they try to create a new one. Experiments are conducted in the start-ups, results are observed and new methods are tried according to those results. Most importantly, there is no standard in the process of operation. Because in fact everything is unknown.
4. Even if you cannot imitate an existing startup, you can embrace its energy and spirit. Think of the start-up culture independently of its physical distress: Think of its passion, individiuality, lucidity, reality, and collaborative structure. You cannot make your employees adopt these elements simply by stretching the dress code.
5. Make the contributions visible: In a start-up, you'll see how your work moves the company forward. It's incredibly motivating to see an idea you're working on turned into a real product or service. In large companies, individual contributions can feel like they are microscopic. It may feel like even if you are not there, the company may be able to continue without any issues. Make sure that your employees feel they are the owner of their work. When you reduce hierarchy, you can give your employees the opportunity to follow their projects and see their impact.
6. Review the Departments: Small and functional teams work better than large teams. Support frequent and fast exchange of ideas within the team. Turn the project into the small fractions of it. Then distribute these tiny projects to teams consisting of 3-4 people.
7. Integrate the Customer Feedback: Startups carry out projects in steps. As they develop, they make changes according to the tests and feedbacks from the customers. Apply the same approach to your business model. Instead of introducing a brand new product and then give promises to customers, use pilot applications to progressively launch new products. In this way, you can both improve your business and benefit the company culture.
8. Listen More and Listen Carefully: The worst enemy of the start-up culture is to hit a mental block. Rejecting change kills creativity and originality. Be agile, be open and listen to what your employees say.
9. One of the reasons why start-ups are successful is that they stop being cautious and do quick experiments. For most well-established companies this is not a practical solution. But you can still change the corporate culture accordingly and try to create a more entrepreneurial spirit.

The Importance of a Growth Mind-Set for Digital Leaders

A many of leaders predicted that in the future their organization would need to either develop or recruit leaders with new leadership skills who are more digitally inclined. Earlier, leaders' capability were mostly gauged by their 'intelligence and emotional quotients' but new digital technologies like cloud, big data analytics, mobility and social networks, are making it compulsory for the leaders to possess a completely new set of skills.

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Digitalization has created even larger leadership gaps in organizations around the world, and leaders today need different skills than in generations past. Digital leaders are a necessity in today's economic environment as the digital revolution has created a whole new area with different rules. The digital technology is changing the "habits of mind" If the way managers think changes then their way of acting and their attitudes will change too .Maybe the digital mind-set will answer this question too.

First it is important about what mind-set means and how can it be defined. According to Research psychologist Carol Dweck (2007) a mind-set is a set of assumptions, methods or notations held by one or more people, or by a group of people. In other words a mind-set is a set of beliefs, a way of thinking. The term comes from cognitive psychology, where its focus is on people from the point of view of information and information processing. Human beings have limited capability to absorb and process information. Mind-sets help to filter what one absorbs and how he/she interprets it. Mind-sets are not stable; they are changing over time as a result of new observations and experiences .In other words mind-set is a mental attitude or disposition that predetermines a person's responses and interpretations of a situation. The mind-set is not unchangeable. It can be changed in order to serve the person's needs (Dweck 2007). It has been observed that a very simple belief about one's self guides and permeates nearly every part of a person's life. This belief can limit a person's potential but it can also enable success. A mind-set influences self-awareness, self-esteem, creativity, ability to face challenges, resilience to setbacks, levels of depression, and the tendency to stereotype, among other things (Dweck, 2007). To put it in a different way, it can be said that the mind-set defines who a person is in his/her everyday life. Dweck, contrasts two types of individual mind-sets: a growth mind-set and a fixed mind-set. Her research reveals that mind-set plays a much bigger role than innate talent when it comes to success. Dweck found in her research, has to do with how people view and inhabit what they consider to be their personality. A "fixed mind-set" assumes that people's character, intelligence, and creative ability are static givens which they can't change in any meaningful way, and success is the affirmation of that inherent intelligence, an assessment of how those givens measure up against an equally fixed standard; striving for success and avoiding failure at all costs become a way of maintaining the sense of being smart or skilled. A "growth mind-set," on the other hand, thrives on challenge and sees failure not as evidence of unintelligence for growth and for stretching our existing abilities. Out of these two mind-sets a great deal of behaviour, relationship with success and failure in both professional and personal contexts, and ultimately person capacity for happiness. People with a fixed mind-set believe that intelligence (along with talent, personality, and other traits and capabilities) is static. Having a growth mind-set begins with the fundamental belief that intelligence (or talent or other personality or capabilities) *can be developed* .That it is not static or predetermined. A growth mind-set is important to digital leaders. Many people must develop them as they adapt to the new challenges wrought by digital world. Organizations can develop a growth mind-set, too.

Dweck's research, there are two primary ways in which individuals approach intelligence and learning: with a fixed mind-set or with a growth mind-set. The fixed-mind-set perspective is one in which individuals believe that they are born with a certain level of intelligence and talent, and that level will not shift over their lifetime. As a result, they tend to believe that things for which they have skills should come easily to them, with little effort required for success. Conversely, those who adopt a growth mind-set believe that intelligence; skills and passions can be developed over time. They seek opportunities to be challenged, to stretch beyond their expected capacity, to take risks, to learn and to gain insight from their mistakes. From a business perspective, the advantages of a growth mind-set culture are evident

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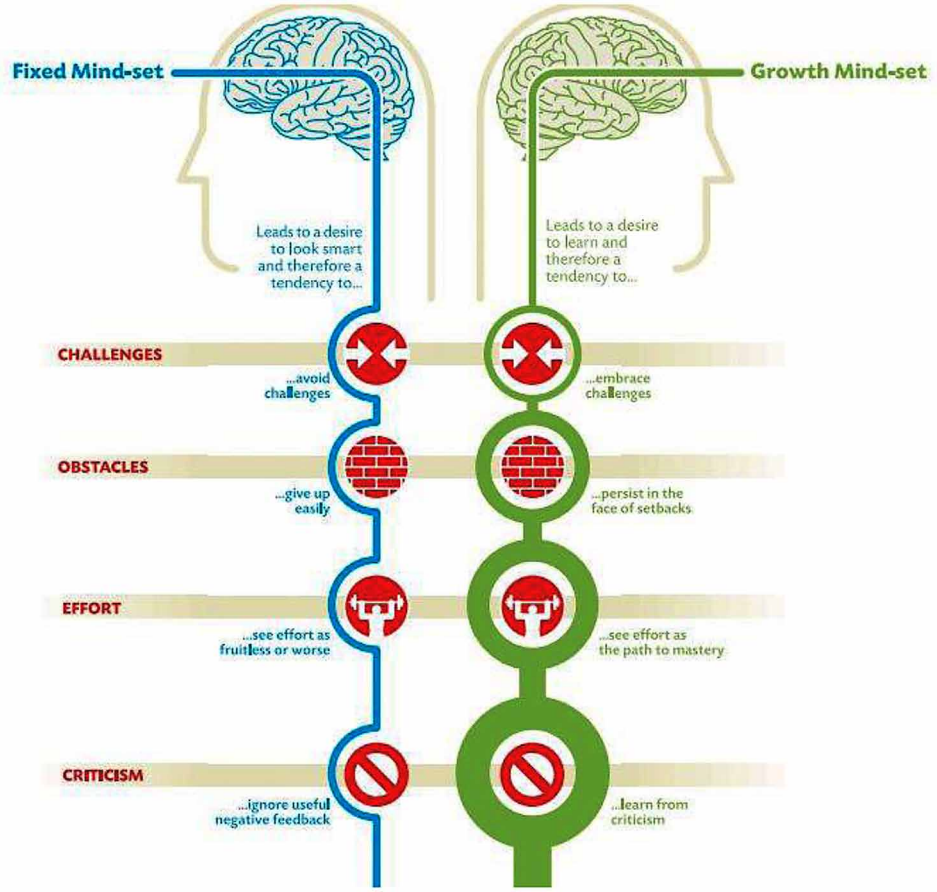
Figure 2. Non-digital mind-sets. Digital mind-set
Own creation based on Dweck (2007)



in Dweck's research. Dweck (2008) found that in companies with such cultures, leaders viewed their employees as "more innovative, collaborative, and committed to learning and growing" (p. 133).

On the whole, these leaders were more likely to view their employees as having management potential than were leaders in fixed mind-set companies. Likewise, employees in growth-mindset companies demonstrated positive views of their organization and their work colleagues (Love, 2018).

As leaders, developing a culture of learning and innovation may be the key factor that allows organization to outdistance the competition. The largest roadblock to growth and innovation is a leader who is closed to receiving feedback. A growth mind-set begins with a good leader. Hence, the key traits of the leaders with a 'digital mind-set' are as follows:

1. Capacity to understand technology: Leaders with digital mind-set possess the ability to visualize the big picture when it comes to technology and they chalk out future course of actions. These leaders are quick to understand, analyse and predict the impact of technology on their business outcomes and take no time to address the demands.

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2. Build expert connections: Here the leaders are not afraid of exploring unknown of the digital world. They accept their limitations and challenges and build their own reliable network of experts to navigate through the unknowns.
3. Invest in research and innovate: Leaders with digital mind-set are also known for their risk taking abilities to completely transform the game. Such leaders encourage experimentation and innovation at every level, by investing considerably in and by providing necessary support and resources to their teams.
4. Build 'Digital Talent': Being visionaries, such leaders understand the importance of managing 'digital talent' in the organization and thus place immense importance on the 'talent management processes and practices'. They tweak their hiring processes to select the best of digital talents and develop them to address the future challenges (Shrivastava, n.d.).

Digital leaders are a key factor in any company's success because they understand which technological innovation to adopt at the right time which will yield the maximum returns for the entire organization. For companies and organisations, technology is fundamentally changing how they deliver their products and solutions, and for some, even what their core value proposition is. We should be aware that everyone's past experiences and expectations tint our perception of reality, and consciously role modelling a genuine interest in the knowledge and expertise of others is the key. One of the best ways to role model learning from others is to develop the practice of regularly asking for feedback. Growth mind-set does not mean that people can perform endless amounts of work, or that anyone can adapt to any situation. But as long as leaders prioritize having the right mind-set, organizations will be better-suited to face any uncertainty the future may hold.

RESEARCH METHODOLOGY

This research is focused on finding out the influence of digital leadership on start-up companies with respect to technological and social influences of Digital Age across different demographics. Thus, a short questionnaire was implemented through semi-structured in-depth interviews in order to find out the influences over organisational culture. In this context, the leaders of 8 start-up companies from Turkey were interviewed and the results were analysed accordingly.

Therefore, this paper attempts to explain and conceptualize start-ups, and recognize the challenges they might face in the valley. Thus, the paper deals with explanation and not all the mentioned reasons why confirm that start-up research is important. Start-ups have been digitalised by their nature. Nevertheless, the digital leadership concept in start-up companies is not the result of an innate aspect, but the obligations brought about by digital infrastructure practices. As the exclusive focus of this study is on whether or not the leaders of the start-up companies in Turkey can adapt themselves to digital transformation with regard to organisational culture, the scale in *Future Work Forum* was administered.

Within this context, three main issues are discussed:

1. Determining the main aspects of Digital Leadership along with transformations in the nature of administrator-employee relations.
2. Explaining the importance of a growth mind-set for Digital leaders.
3. A research on digital leaders in start-up companies.

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LIMITATIONS

The primary aim of the work is to draw attention to the influence of digital leadership on start-up companies with respect to technological and social influences of Digital Age across different demographics. Thus, a short questionnaire was implemented through semi-structured in-depth interviews in order to find out the influences over organisational culture. In this context, the leaders of 8 start-up companies from Turkey were interviewed and the results were analysed. The sample of this study may seem rather small; however it is an initial step in a relatively new concept in the literature and the scope is going to be enlarged in further studies. It is an undeniable fact that more information on digital leadership would help us to establish a greater degree of comprehension on this matter.

FINDINGS

The following issues have been discussed in the study:

- The number of employees in 25% percent of the start-up companies is 11-100, and equally in another 25%, the number is less than 10.
- As for the positions of the participants, most of them are chief executives and middle managers with equal ratios of 25%
- The participants are predominantly in telecommunications / communications sector, which is followed by financial service, federal IT and technology, professional services education and primary industry.
- It has been found out that 50% of the participants strongly agree with the idea that "leaders set a good example of work/life balance."
- Moreover, 50% of the leaders participated in this study think that their corporate workplace includes informal lounge areas for employees relating where possible to their current organization.

Next, 38% of the participants stated that they offered flexible working to all employees. Similarly, 63% of the participants agree that they have discouraged the long hour's culture. Therefore, it can be thought that there is a significant positive correlation between their views towards flexible working hours and long hour's culture.

Furthermore, most of the leaders of start-up companies firmly believe that they have invested in collaborative technologies to support remote work. Noteworthy, 50% of the leaders in this study strongly agree and % 38 agrees that they provide encouragement to their staff for their using social media as part of their work.

In the same way, 38% of the participants think that too much time is spent in unproductive and boring meetings. However, the ratios of those who disagree and weakly disagree (25% each) with this idea should also be taken into consideration.

As for adaptation of digital generation into corporate culture is concerned, 50% of the leaders assume that they have achieved it. Nevertheless, the ratio of those who weakly agree with this should not be neglected.

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The participants agree and strongly agree with equal ratios (38%) that they have transformed their leadership for the Digital Age. From the results obtained, it can easily be inferred that participants value collaboration more than control.

Interestingly, contribution of flexible working to business success is considered rather negatively by the participants. In addition, most of the participants point out that they train their team leaders to conduct effective meetings (both face to face and virtual).

Most of the participants consider that they value employees who have balanced lives. On the other hand, the ratio of those who weakly disagree with this approach should not be overlooked.

A high percentage of the leaders strongly agree (13%) and agree (38%) that they allow employees to work from home. Nevertheless, there seems to be a contradiction in such a tolerant approach as the percentage of those who weakly agree and disagree is 50%.

As far as proving 'hot desks' for shared use is concerned most of the participants agree and strongly agree with that practice. Nevertheless, there appears to be a disagreement over the view that the participants value networks over hierarchies. While the ratio of those who agree and disagree with this idea is totally 38%, the ratio of those who disagree is 64%.

In addition, most of the participants (88%) are in favour of the idea that digital technology has empowered employees. A high percentage of the participants place trusts in their employees that they can manage their own work (see Fig. 21).

According to the findings, there is a clear trend of managing people on results not on hours. Yet, no matter how small, the ratio of those who disagree with this should be paid attention.

Finally, a high percentage of the leaders affirm that they have trained their managers in new ways of working.

SOLUTIONS AND RECOMMENDATIONS

The main issues discussed have been summarised under 13 items as follows:

1. Eight of the total start-up companies surveyed in Turkey is seen mostly as a maximum of 100 people. In terms of digitalization of start-ups, it is thought that size is not important. What is important here is that the company culture is compatible with the new technology, it is not static, and its employee relationships and behaviors are compatible with digital culture. Digital transformation reshapes every aspect of a business. As digital technology continues to evolve, successful digital transformation will require careful collaboration, thoughtful planning, and the inclusion of every department. As highlighted by Newman (2017) Modern enterprises succeed when they adapt to industry and marketplace shifts and incorporate new technology into company culture and regular operations. However, digital transformation isn't only about technology, it's about bringing together the power of technology with a culture that embraces the change that it can lead for the organization.
2. The positions of the participants in the company are mostly chief executives and middle managers. The upper and middle level authorities are effective in determining the company culture and consider the digital transformation as a necessity.
3. Participants were identified as the start-up companies in the Telecommunications / Communications, Financial Service, Federal IT and Technology sectors. Such companies are more aware of the importance of the digital development and of the necessity of adapting it to their own institutions.

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In the digital world, leadership is now viewed as a sectoral position rather than within a company. For example, the leader of a technology company that has revolutionary products is seen as the leader of the entire industry. Toduk (2014) indicates that people living in Turkey can adapt to the usage of products such as social media and smart phones that the digitalization brings and are far ahead compared to the other similar economies.

4. Start-up company leaders embrace the idea of setting a good example of work/life balance. Leaders also value their employees who have balanced and orderly lives. As Toduk maintains, leaders need to stay natural, avoid artificiality. In the past, people could turn into very different characters in their personal and business life because these two worlds were very different. Today, especially because of the social media, the wall between these two lives are removed. Therefore, it is very difficult for managers to show a different persona in business life. One of the features of the digital leadership is defined as Authenticity. Workplaces with digital infrastructure enable a more flexible business culture. Therefore, it is important to consider the necessity of informal lounges, which allow employees to share their thoughts and create creativity.
5. The managers of start-up companies in Turkey think that employees should be flexible. Also, within the scope of the research, leaders do not support long hours of work of the employees. "Balser (2014) proposes a new "organic, flexible, and adaptive" narrative for leadership (p. 1065). El Sawy et al. (2016) define digital leadership as "Doing the right things for the strategic success of digitalization for the enterprise and its business ecosystem…Most commonly, it is viewed as the process of transforming the structure, processes, people skills and culture of the entire organization so it can use digital technologies to create and offer products, services and experiences that customers, employees, and partners find valuable" (p. 142). The corporate leader is the reflector of the corporate culture. Therefore, corporate flexibility is communicated to the employees through the leadership.
6. The leaders of start-ups have said they support technologies for collaboration to support remote work. Leaders today are expected to be equipped with diverse aptitudes and abilities than in previous eras. As a consequence of quickened cadence of mechanical change and globalization, human resources is even more demanded to help organizations beat the arisen difficulties of computerized change. At this point, the role of digital leadership in embracing new technology is quite important. It is imperative for leaders in administrative positions to adjust themselves to profoundly new conditions caused by digital transformation. One thing is certain that a drastic change in the direction of management, that is, from bureaucratically vertical to horizontal administration, has taken place.
7. The leaders of start-up companies think that employees should be supported on social media use. The use of social media has become a necessity when the business processes of start-ups are increasingly digitalized. Therefore, employees are encouraged to use social media more. This is also by the nature of the digital leader. Another result of the research supports this. According to those results, the leaders think that they too must adapt to the digital age.
8. A common opinion among the leaders of the start-up companies that the meetings held in the institutions were time-consuming and inefficient did not emerge.
9. It is stated that such companies adapt their corporate culture in order to influence the digital generation. The digital generation is naturally innovative, has an entrepreneurial spirit, and is in a creative and competitive trend. Considering this, it can be seen that the Strong Digital Culture increases productivity and innovation to maintain a competitive edge, Digital Culture is the key missing ingredient for Digital Transformation, is crucial to winning the war for talent by empowering and

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engaging all digital generations. According to the research, start-up leaders are being adapted to the digital age. This is because they can only adapt the digital culture in this way. In addition, the leaders support the training of employees according to new forms of work.

10. Leaders value cooperation more than control. This new administrative structures refers to "connected leadership" (Jarche, 2016), which is not given from the top since there is no 'top' in the system. To realize the work culture, connected leaders should immerse themselves in it. This is would be impossible while endeavoring to control the culture. By looking for, detecting, and sharing, everybody in an association can turn out to be a piece of a learning system, tuning in at various frequencies, perceiving examples, and settling on better choices. We value collaboration more than control.
11. The idea that flexible working hours contributes to the company's success is not received positively by the majority of the participants. Although the institutions have the digital infrastructure requires flexible working conditions in the context of digital culture, start-up company executives in Turkey are negative about the flexible working conditions. According to Grunig (qtd. in Mengü, 2013), the general cultural structure of the society affects the cultural structures of the institutions in that society. The situation in Turkey might exemplify this. However, leaders in the research also stated that they could give employees the freedom to work from home if they wanted to, and that they trusted them to manage their work. At the same time, leaders want employees to work for results rather than hours.
12. Leaders believe an effective meeting can be conducted both face to face and virtually. Officials can likewise complete a ton to instruct themselves, for instance by trying different things with the most recent contraptions, observing how their youngsters use them, or by utilizing free assets on the web. (p. 4) Likewise, organizations should create training strategies to assist executives and employees to develop the skills they need. Furthermore, leaders understand the importance of managing 'digital talent' in the organization and thus place immense importance on the 'talent management processes and practices.'
13. According to the research, leaders consider hierarchy above their communication networks. In fact, this is contrary to digital leadership. According to individualization, one of the characteristics of digital leadership, managers need to evaluate their employees individually according to the needs of individuals by seeing the differences between them. Former leaders led teams. Now they will have to manage individual employees. On the other hand, there is no individualization in the hierarchical structure. There is a superior-subordinate relationship. According to another result of the study, the leaders consider the hierarchy above the communication networks, while also considering that the digital technology strengthens the employees. In hierarchical institutions, the individual becomes weak. Therefore, a contradictory situation arises.

FUTURE RESEARCH DIRECTIONS

There is abundant room for further progress in determining the transformation towards digital leadership which has evolved incredibly to this day and will continue to evolve in even more unpredictable ways. The managers of the future will need all the flexibility, emotional intelligence and creative thinking they can achieve.

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Regarding that the leaders of 8 start-up companies from Turkey were interviewed, the sample of this study may seem rather limited. Nevertheless, it should be considered initial step in a relatively new concept in the literature and the extent in similar studies of can be larger.

CONCLUSION

Technology is at the core of the digital transformation. Leaders needs to focus on acquiring new skills and constantly review the tech tools their employ internally but also externally. They have to learn how to use virtual reality, augmented reality, facial recognition and other relevant technologies."Leaders, need to progress to managing changeces. Leaders cannot simply "manage" work. They have to engage their workforces and inspire people to participate. It's not enough for leaders to know what they want to achieve. Collaboration is the key to success for leadership in the digital age.

Leaders need to learn to do more with different. Do more diversity. Do more creativity. Do more innovation. Do more change. Do more flexibility, more coaching, more encouragement and support (Groscurth, 2017).

Digital leadership innovation should not be considered as considered static but evolving in time. Since technology innovation is so highly dynamic the mix of leadership skills required also changes. Digital leaders are a necessity in today's economic environment as the digital revolution has created a whole new area with different rules. The digital technology is changing the "habits of mind" If the way managers think changes then their way of acting and their attitudes will change too.

Digital leaders are distinguished from non-leaders by their different combinations of skills, attitudes, knowledge and their professional and personal experiences. Leadership must be driven by unique attitudes appropriate for the distributed, digital age. Digital leaders must be flexible and adaptable, and possess wide intellectual curiosity and a hunger for new knowledge. They must be willing to see value in sharply different perspectives, and be comfortable with uncertainly, and like all leaders at all time, must possess true passion for what they do. They look globally for solutions and challenges, and also hunger for constant learning and insist on constant learning from their collaborators and followers (Wilson, 2015).

As a business model trend, astart-up actually represents the start of a company from scratch, in other words, an enterprise. It is also called as such in Turkish. In start-ups, from the production stage to the rise of the company and from there to the possible difficult situations, you need to create an atmosphere in which you will be happy, proud of your ideas. One of the most important elements in start-ups is a proud and excited team. In a start-up, just the excitement of managers is meaningless. The team should always be encouraged to be proud and excited.

Start-ups in Turkey has evolved in recent years and they have made innovations and pioneered new concepts. Global Marketing and Communications Manager of Digital McKinsey's Digital Labs, Peri Kadaster stated that "Turkey has a great potential for start-ups. The important thing is the tendency to develop. In recent years in Turkey, it can be seen that the digital is being re-converted and start-ups are aware of the importance of this transformation" (Kadaster qtd. in Baş, 2018) after indicating Turkey had no delay in entering the start-up arena and more and more organizations are becoming active members of the start-up ecosystem.

In Turkey, the total investment amount of close to 5 thousand start-ups is about 431 million dollars. Start-up is the most preferred way for companies that have just started to operate in recent years. Start-ups that are expressing technology initiatives are growing very fast, making an innovative difference in the

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field beyond of just being new enterprises. Furthermore, Kadaster mentioned that Turkey had no delay in entering the start-up stage, and even said that Turkey had pioneered the innovation and evolution in this regard. The main reasons that Turkey had such success in the start-up arena are as follows: Turkey's population's 50 percent is under 30 years of age, Turkish customers are conscious about technology, related disciplines in higher education are developing and there are successful examples in the field such as "Gittigidiyor" ("Türkiye'de girişimcilik evrim geçirdi").

The co-development of start-up companies and digital infrastructure has made it necessary for them to adapt to the speed of digital transformation and to fulfill the requirements of digital organizational culture. In the digital age, elements such as flexibility, collaboration, listening and motivation have become extremely important to increase company success. Start up leaders should also consider these elements.

As leaders, developing a culture of learning and innovation may be the key factor that allows organization to outdistance the competition. when they are up against challenges could easily cause their to lapse back into a fixed mindset. Leaders, learn to tune into that inner dialogue and counteract it with statements that help their stay on track with stabilizing their growth mindset. Skilled business leaders are impressively flexible. They know how opportunities can become apparent time. Being aware of what the growth mindset is and trying to develop it within their self will cause there to seize opportune moments more than ever before, especially when doing so could take their business to a new level. Now that they know what a growth mindset is and how it could enhance their leadership skills.

The last but not the least, many companies are beginning to make the necessary changes to adapt their organization to a digital environment. As a result of 8 interviews with start up's leaders, it is assumed that this research study has provided some important insights into how leaders are adapting to a digital business environment.

The characteristics that the managers of the specialized companies need to have are speed and deformability, as opposed to the collectors. Hence, the managers of such firms may have to quickly change the strategy or stop the business if they realize that their companies have been left behind by competitors or not being sufficiently demanded in the market. CEOs of the specialized companies of the future must anticipate that their companies may be short-term assets. People need to quickly learn the requirements of digital economies. Otherwise, they may face the risk of losing their jobs in 10 years. Managers need to raise the innovative spirit of all employees in their companies and ensure that they work as entrepreneurs. It is not enough to cooperate within the company. Managers also need to contact people from outside the company to develop their networks and cooperate with their competitors if necessary. In the digital world, leadership is now viewed as a sectoral position rather than within a company.

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KEY TERMS AND DEFINITIONS

Digital Age: The time period beginning in the 1970s with the advent of the personal computers providing the technological capabilities to transfer information freely and quickly. This period is also called the information age.

Digital Leadership: The strategic use of a business enterprise's digital assets to reap commercial enterprise goals.

Digital Transformation: Elaborate transformation of enterprise and organizational activities by means of several methods, skills, and models to absolutely leverage the adjustments and possibilities of a combination of digital technologies in a strategic manner.

Growth Mind-Set: Overall attitude of individuals to reflect considerations or think about things and make decisions.

ICT (Information and Communications Technology): Activities pertaining to electronic technology and computer systems of digital generation.

Organizational Culture: The underlying ideals, assumptions, values, and approaches that provide contributions to the particular social and mental environment of a business enterprise.

Start-Up Companies: New small companies or businesses, the activity of which entails computers or the Internet.

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Chapter 10
Artificial Intelligence Leadership:
Imitating Mintzberg's Managerial Roles

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ABSTRACT

New developments in technology may cause massive changes in the organizational and managerial contexts as well as daily life. The aim of the research is to discuss how AI may affect the future of business life in respect to leadership and management. Additionally, questioning the possibility of artificial intelligence leadership. For this purpose, AI will be evaluated with regard to managerial roles defined by Henry Mintzberg. Evaluation of the managerial roles within the scope of AI leads us to think that AI will have a rich potential to lead and manage human beings. According to capabilities of AI, it can be suggested that AI might produce better results than human beings in the context of the managerial roles. AI leadership discussion gives a chance to shed light on today's management practices in a critical manner by comparing imagined AI with human being managers.

INTRODUCTION

People were in a discussion about the idea of cyber workers to replace human being in manufacturing and service sectors for decades until Industry 4.0 has attracted attention to the idea of cyber white-collar workers with new approaches to the high amount of data to be processed, direct communication needs of objects, and more productive business models. Industry 4.0 promises countless massive changes at the business models, production styles, and management systems relating to rapidly developing technology. It can be said it's time to focus on how artificial intelligence (AI) will shape the future of the business and the world accordingly. Accelerating speed of business, increasing importance of time, diversification

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of considerable data sources, difficulties of processing high amount of data and obstacles to evaluate environmental conditions led researchers and practitioners to think about alternative decision-making methods and systems. Decision-making is one of the essential topics of leadership studies. Researchers investigate how leaders make decisions and how the decisions affect the success of organizations (Fernandes & Simon, 1999; Tozlu, 2016). In the context of AI which allows evaluating and processing high data which is flowing from a wide range of sources, leadership studies need to adopt new approaches.

Today, many research projects are being performed to enhance the capabilities of autonomous systems that will be able to make the most sagacious decisions. Mentioned researches carry one step further the expectations from conventional robots and machines. Conventional robots mean repeating certain motions or calculating certain data. Therefore, typical outputs of robots' each activity mostly have no difference. However, AI systems can produce various outputs in accordance to work designs, upgraded data, and its unique learning ability. At present, countless companies are investing in research and development works for AI to have competitive advantages. Usage area of AI is expanding over time; defence industry, medical, power plants and electric power transmission lines etc. US Army Vision reports emphasise autonomous systems and AI for the future modernization plans. Besides the unmanned air crafts that widely utilized at present, autonomous war vehicles are expected to be in use at war operations by 2028 (Edwards, 2018). Autonomous weapon systems might be able to establish targets, search and destroy the enemy units autonomously. Moreover, they might have a role to lead the human being soldiers and other synchronised war machines in the field. Regarding to horrifying skills of AI, 116 founders of robotics and AI companies including Elon Musk sent a letter to United Nations to ban autonomous weapon systems (Bachman, 2018).

The aim of the research is to discuss how AI might affect the future of business life in respect to leadership and management. For this purpose, AI will be evaluated in respect to managerial roles which are defined by Mintzberg (Mintzberg, 1971). Evaluation of new developments in technology is a need to see how business environments evolve. In consideration of anticipations which declare AI will have a very wide range of application, leadership and management fields should not be thought out of this frame. Especially, when it's considered AI researches and leadership studies have various common and main topics such as decision-making, evaluating environmental conditions (processing big data) and enhancing versatile capabilities (learning ability). The current study does not mention the usage of AI applications as an information provider or supporting systems for decision-makers in an organizational setting but mentions cyber or robot leaders with AI that directly and autonomously lead human being employees about how they should work and implement efficient allocation of resources according to organizational goals. Even if AI leadership sounds as anomalous in the context of the current comprehension, rapidly developing technology is leading us to think about cyber leaders in the business organizations.

WHAT'S AI?

The researches in technology development mostly aim to make innovations which replace human beings or living organisms as a part of easier business or life conditions. Developed machines and tools facilitate the business and the daily life. Until the appearance of computer systems, developments were about supporting human being in a physical manner. Computer systems could accomplish solving logical complex problems however they were far from cognitive abilities of human brain. Researchers focused to invent

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smart systems which imitate the functions of human brain such as decision-making and perception. The term *Artificial Intelligence* is used to describe smart systems in general. Thomas and Liang (2016: 1) defined artificial intelligence as follows;

Artificial intelligence (AI) is the theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages.

AI has its own specific techniques such as artificial neural networks, deep learning, expert systems, genetic algorithms, fuzzy logic and so on (Kaya & Engin, 2005: 107). However, with the purpose of staying focused on the aim of the current study, general abilities of AI will be mentioned. AI skills and techniques will not be detailed.

BRIEF HISTORY OF AI AND RECENT DEVELOPMENTS

.Even if the AI concept is so popular at present, the idea of unmanned systems is not so new. Automats can be mentioned as earlier unmanned systems such as the founder of cybernetics Al-Jazari's Time Telling Elephant (Hatun, 2012: 207). Automats could repeat certain motions automatically and there is no chance to talk about decision-making for them. In 1769, Wolfgang von Kempelen took cognisance about automats a step further. Kempelen's automat called *Turk* was able to play chess with its human being competitor. It means Turk was able to realise the competitor's move and decide how to react. Although the explanations about the magic of Turk were as it was just a hoax, it could achieve to attract attention throughout Europe and United States. Napoleon played chess with Turk in 1809 after 5 years of Kempelen's death. Other famous players against Turk were Benjamin Franklin and Charles Babbage (Burton, 2002: 134; Wyatt, 2012: 103; Kidwell, 2015: 579). The Turk could success to inspire people about smart systems even if it was just a hoax or an illusion. Approximately, 150 years after the Turk, Spanish inventor Leonardo Torres Quevedo demonstrated a machine that can play chess automatically thanks to its mechanical system, called as El Ajedrecista (Byrnes, 2016: 62). In the early 1940s, studies of Warren McCulloch and Walter Pitts made significant contributions to *logical calculus* and *how we know universals* that point the way to understand certain brain activities (Aizawa, 2012: 206 – 217; Byrnes, 2016: 62). In 1950, Alan Turing in his illustrious paper *Computing Machinery and Intelligence* questioned that "Can machines think?" and shared his anticipation that machines would have an advantage against human being by 2000s (Wirth, 2018: 436; Byrnes, 2016: 62). John McCarthy – known as the father of AI- held meetings which are known as *Dartmouth summer research project on artificial intelligence* in 1956 and he continued to work on AI in following years (Wirth, 2018: 436; Sabanovic et al., 2012: 99). AI could attract attention of scholars in Europe after 1965. As of this date, several academic meetings and researches were implemented (Sandewall, 2014: 81). Various attempts could be mentioned since 1972 but the match between Kasparov and IBM's AI system called *Deep Blue* in 1997 is accepted as a milestone in AI researches. In this match Deep Blue defeated World Chess Champion Garry Kasparov and thereby Turing's prophecy came true (Roberts, 2016: 15 – 16). By the 2000s, AI started to be used in a commercial manner. IBM's Watson, Apple's Siri, Amazon's Alexa represent early

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commercial applications of AI. Watson is highly assertive about it can assist for contract management with its semantic analysis ability (IBM, n.d.).

Today, there are many AI systems in commercial use and AI could found wide range of usage area such as e-commerce, total quality management, marketing, human resources management and so on. There is no doubt for today's businesses; AI creates significant differences in the manner of competitive advantages (Jabłońska & Polkowski, 2017: 13; Kaya & Engin, 2005: 103). But researchers have greater expectations for the developments in AI. Many of them focused on machines to have learning, decision-making, case-based reasoning skills (Kobbacy et al., 2007: 11). AI researches rapidly progressing to move the capabilities further. The researchers already fall under artificial superintelligence's (ASI) spell which emphasizes software smarter than human being. ASI will have the ability to enhance its own capabilities. At this point, a group of researchers and philosophers point the dark side of the Moon. Stephen Hawking, Steve Wozniak, Nick Bostrom, Elon Musk draw attention to ASI might attempt to destructive actions against human being (Roberts, 2016: 18 - 19). Recent discussions lead researchers to muse over ethics of AI (McKenna, 2018).

Even if Japanese Asimo and Swedish Yumi robots have already conducted orchestras in a symbolic manner, today it is not possible to talk about any management experience of AI. The idea of AI leadership is so new and there is no experience which can allow comparing human being with AI in the management. But current achievements of AI and expectations from AI allow us to generate significant assumptions. First of all, AI studies aim to imitate human brain with its all functions (Serhatlıoğlu & Hardalaç, 2009: 1). Besides that recent developments showed that AI did a better job than imitating (Vance, 2018: 64; Wirth, 2018: 436). A recent study declares that AI can diagnose disease better than doctors by processing more data in a shorter time (Xiaodong, 2018). In this regard, if machines will be able to accomplish human being activities which might need cognition, then they should be able to accomplish managerial tasks as well. Another assumption as a guide for the current study is that human being will be perceived insufficient to make sagacious decisions in the face of too much complicated problems that emerges depending on rapidly developing technology. At this point, a clarification needs to be done. Any AI doesn't mean that will have ability to implement all tasks and solve all problems. Most probably AI systems will have abilities depending on the requirements of positions and organizations. Just as, a single human being is not able to be productive in all environments; AI is not expected to fulfil all requirements in all circumstances. AI is expected to be used in specific positions which the requirements meet the abilities of AI. Another issue to take into account is increasing variety and intensity of data, flowing from countless sources. AI is expected to integrate all the established data sources and thereby AI will always acquire the latest information immediately with its synchronised structure. In the other words, AI will always be upgraded instantly. For the current situations, AI is thought as a supporting system for decision-makers but it means time loss exactly. Making decisions and taking actions will take longer time than AI to initiate directly. Besides that, the option of AI to have managerial roles must be discussed since AI can make a significant difference in decision-making.

MANAGERIAL ROLES WITHIN ORGANIZATIONS

Understanding *what management is* and *what managers do* should be questioned relating to the AI leadership. A clear definition of managerial roles is essential to understand what is expected from AI if

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it is foreseen to take the place of human being at the managerial positions. Henry Mintzberg, one of the senior researchers in the field of management, suggests that managers have numerous roles in the context of organizations. Mintzberg's comprehensive definition of managerial roles can provide a clear understanding for the current study. Explanation of Mintzberg (1971: 97) about managerial roles as follows;

Managers perform ten basic roles which fall into three groupings. The interpersonal roles describe the manager as figurehead, external liaison, and leader; the information processing roles describe the manager as the nerve center of his organisation's information system; and the decision-making roles suggest that the manager is at the heart of the system by which organizational resource allocation, improvement, and disturbance decisions are made.

Mintzberg's taxonomy is a facilitating tool to understand what managers exactly do. Furthermore, it can be suggested as a loadstar for the AI leadership researches.

An extensive comparison of the statements of Mintzberg about managerial roles and current achievements of AI researches will be the main method of the current study. With this respect, comprehensive evaluation of managerial roles explained by Mintzberg, will be implemented for seeking an answer to the question "Can AI replace human being in management level?". It will be questioned that what extent AI can implement managerial roles, by viewing current achievements of AI researches. Additionally, AI's possible further achievements will be tried to anticipate according to AI leadership.

Decision-Making Role

Mintzberg (1976: 15 - 18) suggests entrepreneur, disturbance handler, resource allocator and negotiator roles to describe the manager as a decision-maker. The entrepreneur role is about seeking improvement opportunities for manager's own unit in the manner of adapting to new conditions in the environment. The second one disturbance handler role was clarified by Mintzberg (1971: 106) as follows:

The organization consists basically of specialist operating programs. From time to time, it experiences a stimulus that cannot be handled routinely, either because an operating program has broken down or because the stimulus is new and it is not clear which operating program should handle it. These situations constitute disturbances. As generalist, the manager is obliged to assume responsibility for dealing with the stimulus. Thus, the handling of disturbances is an essential duty of the manager.

Mintzberg attracts attentions to the uncertainty which emerges with unfamiliar circumstances and makes difficult the decision-making process for managers. Another point that Mintzberg (1976: 17) emphasized the reason of disturbances arise is managers to ignore stimulus or to fail at anticipating the consequences of the actions they take. The third role explained by Mintzberg (1971: 106; 1976: 17) is resource allocator role. This role is about the responsibility of managers to make a right decision about who will get what kind of the resources and the amount of the resources to be used. This role is not less important than other roles. There are two main points to take into consideration regarding to the resource allocator role. First, the resources are always limited and renewing them may not be possible if the previous use is only a waste. Second, units in the organization most probably will fail to achieve their goals in case of lack of enough sources. The importance of the resource allocator role of manager and

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how it is connected to decision-making can be seen obviously. The fourth decisional role of manager is the negotiator role. Mintzberg (1976: 18) claims that managers spend considerable time in negotiations. On behalf of managing negotiations, managers need comprehensive information which can be acquired with data processing, about environmental and organizational variables such as resources.

Decision-making is a key concept for both AI and management studies. AI researches are based on the idea of creating thinking machines or computers like human being. Problem solving methods of human being can be considered as an inspiration for AI researchers (Collins, 1984: 58; Meinhart, 1966: 294). In the early stages of AI studies, the researchers were already aware about computers could accomplish complex tasks such as decision-making (Meinhart, 1966: 304). Conventional machines are able to move automatically and implement limited tasks which are mostly repeating and producing typical products. One of the main distinctive features of AI from conventional machines is decision-making ability. Thus, at present, AI researchers' main struggle can be counted to make computers to gain decision-making ability. AI obviously appears as a distinctive factor that can make substantial changes in decision situations in organizational settings with its ability to acquire knowledge and expertise (Lawrence, 1991: 195). In some cases, management is defined as "decision-making activity". This explanation indicates how decision-making is centric for management.

Preferences of managers from a variety of options can be defined as decision-making (Koçel, 2013: 104 - 109). However, decision-making process gets more complicated in practice. Herbert Simon, one the most famous pioneering researchers in the fields of AI and management, introduced *Bounded Rationality* which implies several difficulties in decision-making process. The theory assumes that individuals can have difficulties in decision-making relating to limited computing capacity of human being, especially against complex or ambiguous problems or in case of insufficient information or time. In this context, *satisfactory decisions* need to be chosen instead of *fully rational decisions*. Consequently, Simon re-questioned the classical approach to decision-making which considers decision-making as a rational process. Studies of Simon brought him Nobel Prize in 1978, which made significant contribution to management, economics, psychology and computer sciences, especially in the field of AI (Koçel, 2013: 109 – 134: Sezgin, 2012: 156 – 162; Tozlu, 2016: 27 – 31). Simon was already one of the participants of McCarthy's famous *Dartmouth summer research project on artificial intelligence* meetings in 1956.

Another approach which focuses on the factors effecting decision-making process is *Framing Effect.* The theory mainly suggests that the wording of defining or presenting a problem can make changes in perceptions and accordingly in decision behaviors (Kühberger, 1995: 238). Tversky and Kahneman (1981: 453) explain decisions' characteristics as follows:

We use the term "decision frame" to refer to the decision-maker's conception of the acts, outcomes, and contingencies associated with a particular choice. The frame that a decision-maker adopts is controlled partly by the formulation of the problem and partly by the norms, habits, and personal characteristics of the decision-maker.

Researchers draw attention to the points to take into consideration regarding to decision-making. According to researchers personal issues are involving to decision-making process. Consequently, it can be seen that decision-making is a complex process with various facets. Managers usually tend to postpone decisions just because of the problem is complicated or avoid to make decision which means to taking a weighty responsibility (Tortop et al., 2017: 191). Therefore, it can't be possible to know which resource is

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required to be used for which objective and how the resource will be used. The indecision context causes organization to lose time. It is declared that most important cost of indecision is time (Koçel, 2013: 111).

Accordingly, it can be discussed that in the business environment AI can make better decisions than human beings. AI leader can make a better forecast to discover the opportunities emerging with the changes in the environment. That is essential for the entrepreneur role. Regarding to the disturbance handler role, AI leader will not react as a human in a chaotic atmosphere. Some reactions such as panic, fear or excitement towards occurring events, will not be observed at the AI systems. Therefore, as it is described with the framing effect, negative situations will not be affective on AI leaders' decisions and AI will be able to make the right decisions in the context of disturbance handler role. Resource allocator and negotiator roles are also directly related being aware of organizational and environmental variables. There is no doubt about how AI is so capable to evaluate various conditions simultaneously. Especially when it's thought that AI has synchronous connections with important data sources. For instance, AI as a hotel manager will be able to know number of guests and employees in the hotel simultaneously. When an employee asks for a leave for the weekend, AI will be able to check the weekend activities in the neighbourhood, weather forecasts, current hotel reservations, and so on, immediately. By doing so, AI will try to make the best guess for the occupancy rate of the coming weekend. Later on AI will decide how many employees are needed to be in the hotel during the weekend and how it will respond the leave demand of the employee. Deciding how to respond for employees' demands can be accepted as a simple activity for a manager but as in the example various circumstances and independent variables should be taken into consideration for each decision. Otherwise, decision-maker may fail to make the right decisions.

Decisions in organizational settings vary depending on the decision-making positions within the organizations. According to Ansoff, there are three groups of decision in the organizational context: strategic decisions, managerial decisions and operational decisions (Eren, 2013: 36 - 39). AI can produce useful data to be used for strategic decisions but most probably human being will continue to make strategic decisions to keep the top management role and control. It can be suggested that AI might have middle level and lower level management roles that make managerial and operational decisions.

Interpersonal Role

Mintzberg claims that interpersonal roles of managers include *figurehead, leader* and *liaison* roles. The figurehead role of manager implies that representing the organization in a formal way. For a supervisor who keeps the middle level management, she/he is expected to represent her/his subordinate group to higher management and higher management to her/his subordinate group. The liaison role is about establishing and keeping contacts with people inside or outside on behalf of the organization. The leader role is about the manager's relationship with her/his subordinates (Mintzberg, 1971: 103; Kumar, 2015: 13; Muma et al., 2006: 66).

Each organization has an identity. A leader can represent of her/his this identity on her/his own. Accepting visitors, representing the organization at the meetings, keeping a consultant position and other related tasks necessitate a reliable awareness about organizational and environmental dynamics. In the near future, by the courtesy of well-designed algorithms of AI, a better performance than human beings might be observed in this context. Especially, in case of important or risky situations human being may fail to remember significant issues or to evaluate the conditions with all details as should be but AI with

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its focused structure can become more successful regarding to evaluate, to explain, to persuade and in total to represent the organization inside or outside the organization. In this manner, it can be accepted that the figurehead and liaison roles of managers can be acted by AI leaders.

Evaluating AI in the context of behavioral expressions as should be is not possible with the current achievements of the AI researches. Only a few samples represent AI such as Sophia which can have a talk with people with almost 62 facial expressions (Williams, 2016). Another research which can provide an insight in the context of how AI leaders can be more successful than human being leaders, is about recognizing emotions. The findings of an experiment conducted at Ohio State University showed that even a basic AI could recognize several emotions more accurately than human participants (Cox, 2018). A company called Affectiva which was born in the MIT media lab in 2009, also works on an AI system that can recognize emotional expressions of human beings (Addex AI, n.d.; Affectiva, n.d.). Such developments indicate that AI promises better results than imagined.

Most of the AI systems focused on computing and data processing ability. Since the aim of AI researches imitating human beings for the artificial systems, it can be suggested that the use of humanoid AI systems as Sophia will enlarge and they will show up with various roles in daily life. Inherently, certain behaviors will be expected from humanoid AI systems in accordance with their roles. Even if the current systems are so far from using behavioral expressions as desired, it's not difficult to forecast that they can acquire such characteristics in the near future. According to the main topic of this study, the current section is based on the assumption of AI systems will be able to exhibit certain human behaviors in a business environment. Already, whole AI researches are based on creating humanlike computers with intelligence and behavioral expressions. Motivating or caring employees in organizational settings might be another featured skill of AI leaders. From this point of view, AI leaders might make more sagacious decisions for the benefits of organizations, employers, employees, customers and other stakeholders. Most especially, egocentric and selfhood decisions -which pertain to human being- might be prevented. Therefore AI leaders might be more preferred by the employees and employers than human being leaders. It can be thought that human being employees would reject to work under non-living systems. A recent study showed that providing adequate information to people about AI can change their attitudes towards the AI leaders (Canbek, 2018: 107). Moreover, It can be suggested that future employees might mostly prefer to work under AI leadership for various reasons. If it is assumed that AI leadership will be able to give the right decisions by keeping the balance of work success and employees' well-being, probably employees will gravitate to AI leadership. If the AI researches might reach the foreseen levels, then AI leaders would be preferred by employees and higher managers as well as bosses or stockholders because of some significant advantages when comparing human being leaders:

- AI leaders will not try to use mobbing behaviors against other employees,
- AI leaders will not try to affront or humiliate other employees by misusing the strength of its privileged position in the organization,
- AI leaders will be able to learn almost everything about employees but will not try to use the acquired personal information just to exert pressure on employees,
- AI leaders will not take place in a competition to get a higher position or to keep the current one. In this respect, it will not be possible to see unethical behaviors acted by AI managers,
- When employees find themselves in a conflict, AI leaders will make fair, objective and neutral decisions among employees,

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- Additionally, it will not be able to talk about discrimination made by AI managers among employees regarding their genders, nationalities, religious beliefs and etc.

Briefly, AI will not use classical managers' disgusting or thoughtless methods relying on egoistic concerns. It can be suggested that employees will have higher motivation levels while working under AI leadership. Additionally, AI leaders can perform more objective and more equitable evaluation and control tasks for the employees' work performances. Objective, transparent and more detailed evaluation could be done by them. Most especially, AI leaders will be more approachable when employees need to get some support from the leader. Unlike human being leaders, AI leaders will always be ready without any tiredness, sleeplessness, weariness and intolerance. They will be on duty 24 hours without feeling any personal needs. Mentioned occasions are spectacular for bosses or stockholders as well.

Information Processing Role

Minzberg (1971: 104) introduces the manager as a *nerve center* of an organization. He emphasizes the managers' positions at the dataflow in an organizational context. Managers may not be able to know all details about a function as a worker who implements the tasks, but she/he is expected to know more about the total organization than any other member. In the manner of business management, countless data sources exist which need to be analysed in depth. All organizations produce a high amount of data with their routine activities. The procurement process, price of raw materials, production capacity of fabric, sale price and volumes, behaviors of competitors, customers or suppliers, advertisement budgets and more can create a considerable amount of data that needs to be monitored and analysed by the manager in a limited time. Processing such big data solely emerges as a problem.

AI is a concept that is directly related to processing a high amount of data. In this regard, a term *big data* is frequently used together with AI. Big data implies that activity of any object can produce a high amount of data such as coordinates, directions, speed, target, changes and etc. Technological developments allowed to process big data in a more effective way. Thus, AI attracted attention of researchers in 2000s with the growing technology (Hoadley & Lucas, 2018: 1; Serhatlıoğlu & Hardalaç, 2009: 1). Today, AI is already in use for processing and evaluating big data which is produced by the companies' activities, commercial relations, customer preferences and environmental conditions. Arçelik achieved significant success in this manner. The company realized a project called *spare parts estimation* which establishes an optimum point for the supply and demand equilibrium by the courtesy of AI. Thus, the production of 350 thousand spare parts is planned by AI (Tezcan, 2018). Analysing the environmental variables and internal factors of business is a vital issue regarding to sustainability of business. Therefore, business analysis is suggested to see the advantageous and deficiencies which consist high amount of complex data coming from numerous sources (Ülgen & Mirze, 2013: 116).

Recent developments demonstrate significant results in various aspects regarding to the information processing role. One of the new AI skills is about text analysing. However, AI capability does not consist of only text analysing. Meaningful texts generation follows the mentioned skill accordingly (Ozkent, 2019). It is not difficult to anticipate that the next step to be a meaningful sound generation to communicate with human beings. Additionally, several companies work on improving compliance skills of AI such as Compliance.ai and Merlon Intelligence. Compliance skill provides AI systems to confirm that a person, an incident or an organization meets the requirements of legislation, regulations, standards,

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rules and so on. It can be assumed an extremely important skill if it is considered how the legal regulations, norms and standards might be very complicated (Compliance.ai, n.d.; Merlon Intelligence, n.d.). There is no doubt that in some cases, managers might tend to avoid involving to analysing such complex and big data. However, AI can process big data in a shorter time and produce significant information. Thus, AI can provide an immediate view of business and environmental conditions depending on its integration degree to the data sources. Automated Insights's AI system Wordsmith does that exactly. It is able to transform thousands of pages of data into insightful narrative within seconds. The human mind might fail or feel tired while evaluating such big data, but it takes only a few seconds with AI. Today, Wordsmith serves many distinguished companies such as Nvidia, Yahoo and Associated Press in a commercial manner (Onemli, 2017; Automated Insights, n.d.). It can be seen that in the near future, AI will be able to analyse and summarize ultimately complex data and texts instantly. This means that AI will have a significant advantageous in the manner or management.

Since AI systems are able to process big data in a short time, they are expected to provide required information to related employees, units, positions or stakeholders as well. Thus, disseminator and spokesman roles of managers as Mintzberg's clarified, might be implemented by the AI systems in regards of their data processing and decision-making abilities. The spokesman role of managers, explained by Mintzberg in the context of the information process, implies that managers to inform interested parties about organizational issues such as performance, policies, future plans (Mintzberg, 1971: 105). As it can be seen, disseminator and spokesman roles of managers are directly related to share of acquired information through the appropriate communication channels. Information type, communication channels and authorized employees or positions for information share can be predetermined according to organizational structure and preferences. Then, AI leaders can perform a better role as a disseminator or spokesman.

CONCLUSION

Mechanization had aimed to increase the production in quantitative and qualitative manners while decreasing the failures that human-induced. Digitalization is already adding much more perspectives to the business world. Managerial failures also might be prevented or decreased by the courtesy of digitalization. Mechanization could not make human beings to place in a secondary position. Contrarily, the role of human being has attracted more focus of researchers and practitioners since the industrial revolution. It's earlier understood that the success is depending on human being and machines to have efficient interactions (Taylor, 1919: 12). As it was in the mechanization era, human being will be able to keep its dominant role in the AI era as being the source of whole knowledge and innovations. Worries about the AI to have an advantage against human being and will be a treat for humanity are irrelevant. Nevertheless, various changes and transitions in business life will be able to be observed in the near future.

Countless management information systems or decision support systems exist but the new developments lead us to think beyond these systems. Significant changes can be observed at needs and characteristics of human beings as a result of developing technology and diversifying communication channels (Kanbur, 2018: 399). New approaches should be discussed as authorizing AI systems to initiate by themselves in the manner of time management and efficient use of resources. In the past, AI discussions were about whether computer systems can imitate the human mind. Today researchers are in a point to discuss whether computer systems can imitate specific positions, especially in management. Human being has

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hegemony on management as all other areas with its unique characteristic: cognition. However, at present an alternative phenomenon is on the stage with its humanoid characteristics such as learning, defining and deciding. Moreover, AI can show much better performance than human beings in some cases. This development needs to be discussed in all areas especially in the management and questions-which are basilar for the current study- must be asked: *why so highly talented systems need to be considered as ordinary employees?* and *why they cannot be considered as managers?*

Today, hundreds of companies continue to work on AI systems to improve various skills. Furthermore, it can be seen that considerable improvements were made at present (Adex AI, 2019). It can be anticipated that many skills of AI which are now being improved independently will be unified in the future and it will be available to see much more sophisticated AI systems. In this context, academics and researchers should focus on how the nature of management will be affected. Accepting AI systems only as a machine or an ordinary processor may obstruct us to see the potential of AI which can make organizations better places and workers happier in general.

According to Mintzberg (1976: 18-19), managerial roles are not easily separable. In the case of a manager having no liaison contact, he/she will not be able to reach external information. In this respect, manager can neither provide required information to employees nor make effective decisions corresponding to external conditions. It can be obviously seen that managerial roles need to be thought as a whole. When it is considered in the context of AI researches, AI systems which designated for limited tasks such as information processing only will not be able to acquire external information at the right time because of lack of direct contacts or employees will not be informed as it should be. In other words, using the huge potential of AI systems will not be possible with their current limited designs. Designing AI systems in the manner of implementing managerial roles as Mintzberg stated, can be more beneficial regarding to the management process in organizational contexts. Mintzberg's taxonomy provides a wider vision for the discussion when it is compared with Fayol's Functions of Management. Mintzberg's taxonomy is more explanatory and detailed about what managers do in the context of management. Evaluating the managerial roles within the scope of AI leads us to think about its possibility. According to capabilities of AI, it can be suggested that AI might produce better results than human being in the context of the managerial roles. The discussion might be enriched if the AI abilities would be evaluated within the scope of contemporary management techniques such as crisis management, virtual organizations, total quality management and etc. It was tried to maintain within the essential boundaries to be focused on the essential point.

Current achievements of AI technology inspire scholars about thinking future of management. As the thought of AI which is leading researchers to investigate and understand human behaviors (Brette et al., 2017: 572), AI leadership studies crack to door open to investigate managerial behaviors in a distinguished manner. AI leadership discussion gives a chance to shed light on today's management practices in a critical manner by comparing human being managers and AI. Management positions and expectations from them can be re-questioned with the current study. Maybe it must be highlighted for whom worrying about AI systems can be broken down or might not perform as expected; human being managers are not so perfect in general. Various characteristics of human being may cause to fail achieving the organizational goals especially ego based problems (Hougaard & Carter, 2018).

Further discussions are required regarding to the legal status of assigning AI leaders regarding to sharing the authority and the responsibilities, however, in case of increasing trends in such way legislative regulations will be required to solve the issue.

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Chapter 11
Critical Success Factors in Enterprise Resource Planning Implementation

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ABSTRACT

Enterprise resource planning (ERP) systems are considered, by many, to be extremely solid, while giving organizations the ability to quickly capture and manage data across diverse sectors. Because the successful employment of an ERP system depends upon skillful implementation, specific factors contributing to successful ERP implementation are essential. What are the critical factors in the implementation of ERP system? How do company administrators and IT professionals perceive the critical successful factors for the effective implementation of the ERP? How are critical successful factors defined? How do IT professionals perceive the influence of critical factors on the effective implementation of ERP in a Phoenix company? In this chapter, the critical successful factors in the implementation of ERP systems will be explored. A single case study was conducted, and the interview data were gathered from 15 IT professionals in a Phoenix, Arizona company. Problems, solutions, recommendations, and future research direction will be presented.

INTRODUCTION

Many organizations are using enterprise resource planning (ERP) for enhancing productivity of their organizations. ERP systems are configurable information systems which assimilate diverse sources of information and data driven processes to benefit multiple functional areas within organizations (Kumar & Van Hillegersberg, 2000). ERP software is a central element for effectively managing business processes within organizations to enhance planning, operations, financial operations, for organizational growth

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(Lotfy, 2015). Indeed, there are numerous documented benefits for using ERP systems. Tambovcevs (2010) noted that ERP software integrated multiple enterprise functions (e.g., production, research and development, financial resource management, human resource management, and marketing), and management functions (e.g., pre-vision and planning, organizing, decision making, activity coordination and control) from a practical aspect.

Numerous company leaders opted to use ERP programs to maximize their business environment. For example, while using a model called FMEA, a company noticed increased productivity and effectiveness while executing a multilayered project with an ERP system (Dabestani, Badakhshian, & Shirouyehzad 2011). Kaniadakis (2012) postulated that business restructuring was a strong force for the accomplishment of tasks with ERP control. Kim, Park, and Lee (2013) elucidated, corporations worldwide were refocusing their business applications toward ERP systems while distancing themselves from in-house information systems (IS). Although the requirements for ERP systems were frequently altered, the systems appeared to be flexible enough for integration into the business processes required by organizations. The ability to employ ERP systems over a wide range of business environments demonstrated their usefulness to companies.

However, some concerns still linger regarding to the use of ERP systems. ERP systems were supposed to help companies with multilayered applications by incorporating all applications into one centralized location while permitting selective accessibility within functional zones. As ERP systems evolved, the need arose to examine the reasons for the success of these structures. Gupta, Misra, Singh, Kumar, and Kumar (2017) identified critical challenges while implementing cloud based enterprise resource planning (ERP); these include customization, organizational change, long-term costs, business complexity, loss of information technology competencies, legal issues, integration, data extraction, monitoring, migration, security, network dependency, limited functionality, awareness, performance, integrity of provider, perception, and subscription costs. The researchers found that small and medium enterprises, as well as large organizations, differed from each other with regard to most challenges except business complexity, integration, monitoring, security, limited functionality, performance, the integrity of the ERP provider. The most important concern for all of the organizations involved challenges related to Cloud ERP and security (Gupta, Misra, Singh, Kumar, & Kumar, 2017).

Since the success of an ERP system depends upon effective implementation, the critical success factors (CSFs) for ERP implementation have developed into an important topic for exploration. Thus, answers to the following questions should offer some insight. What were the success or failure rates of executing a multilayered system such as an ERP without concerning CSFs? How did failure affect the overall growth of the organization? It appears that these questions are important to consider when implementing an ERP system. To completely assess the potential success or failure of a company-based implementation of an ERP system, the critical success factors (CSFs) need to be emphasized and carefully considered.

Numerous companies within the State of Arizona use different technologies to enhance their performance and management. The most prevalent offerings involve ERP programs employed at different companies; these include Solar Winds, Manage Engine, Oracle, CA Technologies, IBM Tivoli, BMC, and InvGate. Biriescu (2013) noted, the programs offered by the aforementioned companies are Web-based, interactive, and involve innovative management tools to benefit companies. The problem was that the ERP implementation, from the management perspective, within the examined company located in Phoenix, Arizona did not work as expected, and the company did not experience the expected outcomes. Important questions to ask are: what challenges did they have during the implementation of ERP

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systems? What is the major issue? It is important to examine other factors that have contributed to successful ERP implementation for organizations. This chapter attempted to explore those critical success factors as related to IT professionals and administrators within a company located in Phoenix, Arizona.

BACKGROUND

ERP systems permit businesses to streamline their processes. However, in some instances, ERP systems were uncompromising and did not permit users to manipulate settings to suit their needs. The execution process for implementing an ERP system can contribute to business success or failure. Before the researchers explored the critical success factors for ERP implementation, the definitions, development, and functions of ERP should be examined.

Development of Enterprise Resource Planning (ERP)

Enterprise Resource Planning (ERP) systems are typically defined as an organizational support technology that allows efficient communication and data distribution services to support major business functions (Molnar, Szabo, & Benczur, 2013). ERP systems may assist with tasks in human resource management, and logistical operations, sales, delivery, and production planning (Molnar, Szabo, & Benczur, 2013). ERP systems began to appear during the earliest days of modern computing, when large mainframe computers were the only computers capable of implementing the planning algorithms quickly—usually overnight. The earliest ERP packages consisted of material requirements with planning functions that assisted primarily manufacturing organizations, calculations of supplier and customer shipment times, and internal production schedules (Jacobs & Weston, Jr., 2006; Sagbansua & Alabay, 2010).

As business management software, ERP can be used to collect, store, manage, and interpret data from business activities within an organization. ERP systems help augment cross-functional adeptness by integrating data travelling through an organization. As with all computer systems, the algorithms and functions that these systems are able to perform were constantly being improved and enhanced. Soon, various companies began offering ERP software packages to large and multi-national organizations, while others acquired or sold their intellectual property to competitors.

In the early to mid-2000s, ERP implementations continued to increase, with sales of top-end packages exceeding $20 million dollars in just software licensing costs. As companies began to incorporate new technology at work, the need to integrate systems became dominant. Normally, large companies operated along diverse functional divisions where each division was separate. As technology changed, so did the necessity for companies to change current applications to achieve the needs of users (Alaskari et al., 2012; Molnar et al., 2013). To retain market competitiveness, companies needed to implement ERP systems. ERP systems allowed companies to integrated their information system to serve all of the departments within the organization (Erkan, 2011). Erkan (2011) stated that ERP systems became extremely vital for maintaining a competitive edge in today's business environment; companies could also implement ERP systems to lower total supply chain costs, shorten times for manufacturing throughput, reduce inventory levels, and expand product choice. The design of an ERP system assisted organizations in becoming better organized as well as promoted growth (Erkan, 2011).

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ERP systems in the current market are capable of supporting even the most complex business requirements and models. ERP implementations are common around the world and many of the top Fortune 500 companies all utilize some sort of ERP system, whether it was procured or internally developed (Frazee & Khan, 2012; Winkelmann & Leyh, 2010). Common ERP systems provide a variety of modules or set of functions to interface with various parts of an organization; the most common functions are: finance, accounting, and general ledger functions; sales and customer relationship management; inventory and supply chain management; employees and human resources; and production scheduling and work order management (Sutherland, 2003).

A majority of the ERP systems available on the market today focus on large organizations and their complex needs. An ERP-tier structure has emerged with SAP, Microsoft, and Oracle being considered as tier-one vendors, while others (e.g., Workday, Epicor, and Aptean) are being considered as tier-two systems that aimed at smaller organizations wanting a targeted industry system or simply a lower price point (Wu et al., 2009). In addition, new implementation options have shown that some organizations prefer a larger ERP package to handle complex functions at a headquarters office, while a smaller package may be more accessible and affordable for smaller remote or branch locations – that is, a two-tier structure (Gill, 2011).

Functions of ERP

ERP was initially based on industry and manufacturing and geared predominantly to mass production, an inflexible process that limits the variety of products available to consumers (Gheorghiu, 2017). The early function enterprise resource planning (ERP) included manufacturing resource planning, which was designed to tackle a specific business process such as managing the mass production of standardized goods on assembly lines (Continelli, 2017). With mass production, the products produced on one production line became identical, making it very difficult to introduce a variety and range to satisfy diverse needs. This type of manufacturing was in direct opposition to customization, which was a more expensive process. Mass production lends itself to only a limited amount of customization, and only when the customer is willing to make it worthwhile for the manufacturer/producer. A minimum order threshold needs to be reached for a new line in order to cover starting costs (Writer, 2017).

Some companies may also have diverse working divisions, where each division is separate, or listed as a solo operation. Companies operating along these parameters need to list information for each zone independently; however, with the introduction of an ERP system, this redundancy was removed (Kanellou & Charalambos, 2013). Within the diverse commerce jobs, ERP systems supported with connecting zones together to shape a more unified collaboration, while eradicating unnecessary data entry (Kanellou & Charalambos, 2013). Jeng and Dunk (2013) specified how the free flow of information throughout the company supplemented tractability and transformation. Transforming the company with novelty across the company efficiently is important because the company has to stay competitive with the surge of market runners and growth of marketing activities.

Since ERP systems can be used to integrate diverse organizational systems and assist transactions and production to increase the organization's efficiency, some companies worked proficiently with the legacy systems employed; however, other companies found it difficult to maintain different applications across multiple departments within the companies. In order to combine the applications over multiple departments within the same organization, some companies chose to implement ERP systems which

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allowed the organization to be a cross-functional entity. Even though ERP systems supported companies in stimulating an end-to-end business incorporation, there were numerous problems besides the achievements that were conversed concerning the usage of ERP systems.

What were the failure rates for executing an ERP system without appropriate understanding of the critical success factors (CSF)? Did the companies take into account of the disappointment or failure rates of implementing this kind of system while monitoring leadership and change management variables? Was it the project management's inability to governor the project or was it an issue with the integration? Although ERP systems were difficult to implement, the reasoning behind the failures was hard to detect. Simplifications were made daily about the effectiveness of technology use when related to cross-functional organizations. Administrators made choices in quotidian and centered on the latest technology integration practices. However, are those practices useful to the achievement of the company? One of the complications was the choice to implement ERP systems without completely recognizing precise CSFs.

In other words, the problem with implementing ERP system was that companies usually did not take into consideration the critical success factors (CSFs) for implementation. In this chapter, the critical success factors in the implementation of ERP system were explored from 15 IT professionals and administrators in a Phoenix, Arizona company. In the following, literature on Industry 4.0, ERP 4.0, Enterprise Resource Planning, and critical success factors will be examined.

Industry 4.0

The future of ERP starts with Industry 4.0. Are all businesses affected by Industry 4.0? Industry 4.0 was first introduced by the German government when they launched a project under the name to digitize manufacturing at the Hannover Messe in 2011 (Gheorghiu, 2017). Industry 4.0 was part of a strategy that promotes the fusion of the online world and the world of industrial production (Pohludka, Stverkova, & Ślusarczyk, 2018). The term clearly hints at the fact that today, the world is undergoing another industrial revolution, brought on by the major shift in power between consumers and producers (Pohludka, Stverkova, & Ślusarczyk, 2018). This is a direct result of the digitization of everything (Pohludka, Stverkova, & Ślusarczyk, 2018).

Although the term Industry 4.0 and the reference architecture model behind it originated from Germany, it's quite clear that the vision and reality of the fourth industrial revolution (as it has come to be known) has caught the attention of organizations across the globe, and it encompasses much more than manufacturing (even though manufacturing is the main sector involved at the moment) (Continelli, 2017). Industry 4.0 is poised to address the emergence of an on-demand economy (Gheorghiu, 2017). So, can Industry 4.0 be interpreted as a tool for manufacturers to respond to a consumer base that has rapidly changing demands and expectations? It is no longer just about the production of goods at the lowest cost, but also about producing those goods with speed and flexibility in order to meet the consumer's continually short-lived expectations and desires (Lasi, Fettke, Kemper, Feld, & Hoffmann, 2014).

One of the principal benefits of ERP is that it helps companies track the profitability of their business model. With ERP systems, a corporation can integrate a more cross-functional competence. In a nutshell, ERP manages all the costs and revenues of a company. It includes capabilities that capture sales, purchasing, or warehouse management information (Gheorghiu, 2017). ERP has the ability to document operations and transactions more accurately, thus providing companies with an even clearer picture, with less cost and revenue errors (Writer, 2017). For example, ERP helps manufacturers better

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track utility costs such as electricity and water consumption by breaking it down to how much each piece of equipment consumes at every location (Gheorghiu, 2017). In addition, ERP tracks the effectiveness and productivity of each piece of equipment. In other words, it tracks how much each piece of equipment contributes to the creation of revenue. Cost and revenue data collected at this very granular level are converted into accounting logic which, in turn, calculates the profitability (Pohludka, Stverkova, & Ślusarczyk, 2018).

ERP systems are known for their ability to manage large amounts of transactional and operational information. This data is typically used to forecast short-term and long-term production needs. ERP in today's competitive and global marketplace must adapt to the demand for a leaner manufacturing process, as well as sharing more of information between manufacturing floor and business systems, in order to achieve new levels of efficiency (Gheorghiu, 2017). ERP providers are obliged to take into account innovations such as the Industrial Internet of Things (IIot), which is revolutionizing manufacturing by leveraging intelligent, connected devices in factories. Better data and process integration are providing even more opportunities to fine-tune their operations (Gheorghiu, 2017).

Today's on-demand consumption models paired with customers' desire for highly customized products require real-time, or live, data (Gheorghiu, 2017). There is an enormous potential for real-time information exchange between the business layer and the production layer that could increase operational efficiency, and enable organizations to become more flexible and responsive to customized, changing demands (Writer, 2017). Major technological advancements such as cloud computing, the Internet of Thing (IoT), cognitive computing and robotics, to name a few, enable ERP to assist manufacturers with just-in-time data. Live data insights can be applied to production strategies that cater to an on-demand consumption model (Pohludka, Stverkova, & Ślusarczyk, 2018).

Customer behavior data constitute the new fuel that drives the manufacturing production line and shop floor management capabilities of an ERP. However, analyzing customer behavior data and translating it into machine configurations requires powerful and precise data collection, as well as powerful analysis technology (Gheorghiu, 2017). On the one hand, ERP must analyze omnichannel customer data, which includes physical and virtual customer touch points monitored with online and in-person data collection tools such as social media listening, website analytics, transaction history and sensors. On the other hand, ERPs must keep track of and analyze data from industrial machines empowered with sensors, software and internet connectivity (Lasi, Fettke, Kemper, Feld, & Hoffmann, 2014).

The goal is for ERP to play a principal role in sustaining flexible production processes that can transform actionable customer insights into tangible personalized products (Gheorghiu, 2017). For instance, instead of bringing components and parts to the assembly line in a standardized manner that produce hundreds or thousands of identical goods, ERPs can indicate certain sequencing of parts that results in customized configurations of products for individual customer needs (Pohludka, Stverkova, & Ślusarczyk, 2018).

Recalls are a common problem in manufacturing, with millions of products being recalled by major companies like Toyota and Tesla (Gheorghiu, 2017). Quality management is essential for companies, because it allows them to respond to issues of recall proactively. This limits the negative impact that recalls can have on both customer satisfaction and the bottom line. In order to pursue this strategy effectively, management requires a substantial amount of data. ERP 4.0 helps companies identify manufacturing issues across the entire supply chain, because it gives companies total visibility into the manufacturing facilities involved in their supply chain (Gheorghiu, 2017).

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For highly sensitive products like food and chemicals, production can be stopped or adjusted as soon as a problem occurs. Since stopping a production line is very disruptive and costly, adjusting batches by changing the mix of ingredients is the preferred option (Pohludka, Stverkova, & Ślusarczyk, 2018). Additionally, all data collected on product quality can be used to create forecasts and simulations of possible future challenges. Simulating recall events can lead to improved corrective actions and lower costs (Gheorghiu, 2017). Consequently, when production or delivery needs to be stopped, ERP 4.0 makes it easier to set things back on track by cutting setup times for machines, thereby quickly adjusting schedules and shop floor operations.

Research Studies on ERP and CSFs

Many researchers have explored the topics of ERP and CSFs in the past two decades. Some researchers focused on the implementation of ERP (e.g., Aladwani, 2001; Ali & Miller, 2017; Anderson & Olandersson, 2013; Chen, Chen, & Tsai, 2009; Curko, Stepanic, & Varga, 2012; Dezdar, 2012; Dezdar & Ainin, 2010; Dixit & Prakash, 2011; Finney & Corbett, 2007; Jayawickrama, Liu, & Melanie, 2017; Kanchana & Sri, 2018; Gupta, Misra, Singh, Kumar, Kumar, 2017). Others have examined the critical success factors in ERP implementation (e.g., Adam, 2010; Ahmad, 2013; Alaskari, Ahmad, Dhafr, & Pinedo-Cuenca, 2012; Aldayel, Aldayel, & Al-Mudimigh, 2011; Alsharari, 2017; Kronbichler, Ostermann, Rol, & Staudinger, 2009; Hatipoglu, 2017; Reitsma & Hilletofth, 2018; Shirouyehzad, Dabestani, & Badakhshian, 2011; Stoyanoff, 2012; Zouine & Fenies, 2014).

Sieber, Siau, Nah, and Sieber (1999) evaluated an ERP system for the University of Nebraska to progress the administrative business aspects of the college. Overall, the ERP systems allowed functional areas to run live reports, which assisted the university with their decision-making processes. Kumar and Van Hillegersberg (2000) stipulated that a key element of an ERP system was how it embodied best business practices. Generalizations were made about the effectiveness of technology use when related to cross-functional organizations. Administrators tend to make decisions based on the newest technology; however, with an ERP system, the company was able to incorporate a cross-functional capability.

Due to more intensive competition around the world, enterprises are facing the management pressure of price, delivery on time and advanced services. In order to win the competition, organizations must optimize the current management flow based on its characteristics; leaders need to adopt information technology to realize the high-effective managements of operation and production so that the working efficiency could be improved. ERP implementation affects the management of the organization. Many organizations have investigated and implemented ERP system for better management. Organizations are creating new management system with the support of ERP system. ERP management systems improve the specialized management and optimize the complicated operation flow, which results in short production period, fast fund turnover, lower cost, high quality and service (Ma, 2009).

Research showed that incorporating a change management program with top management and project managers promoted a more successful outcome (e.g., Aldawani, 2001; Bullen & Rockart, 1981; Curko et al., 2012; Kavanagh & Ashkanasy, 2006; Lines, 2004; Martin & Huq, 2007; Maleki & Anand, 2008; Nikolaou et al., 2007; Plant & Willcocks, 2007; 2009Shaul & Tauber, 2013; Todnem, 2005; von Urff Kaufeld et al.). A change management program allowed an organization to manage the transformations required with an ERP implementation (Kavanagh & Ashkanasy, 2006; Todnem, 2005). The change management program allowed the management to communicate changes as well as to promote educa-

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tion of the transformation throughout the organization, which encouraged a better outcome of an ERP implementation (Maleki & Anand, 2008; von Urff Kaufeld et al., 2009). With the implementation of ERP system, the organization changed how the company did on daily tasks and allowed the employees to ascertain the scope, goals, and events required during the ERP implementation at the beginning of the procedures.

ERP and the management of an organization are closely tied. The more transparent the procedures was with the employees, the better the success of the ERP implementation. Communication between employers and employees and the employees' involvement are vital for ERP implementations. It is important for project managers and top management to continually communicate changes throughout the organization, so all employees in the organization are aware of the changes (Maleki & Anand, 2008; Curko et al., 2012).

Organizational culture is also related to ERP implementation. Cultures developed within organizations were critical aspects regarding the success of an ERP implementation and must be supervised to ensure the implementations do not fail (Kavanagh & Ashkanasy, 2006; Lines, 2004; Maleki & Anand, 2008; Martin & Huq, 2007; Meissonier et al., 2013; Plant & Willcocks, 2007; Schniederjans & Yadav, 2013; Todnem, 2005). As with any organization, cultures form over time. Incorporating a change into an organization not familiar with transformation caused friction (Plant & Willcocks, 2007). As organizations grew, so did the culture within those organizations (Schniederjans & Yadav, 2013). When incorporating an ERP system, it was vital for the organization to understand the culture within each department because this culture determined how successful the implementation was from the beginning (Martin & Huq, 2007; Todnem, 2005). For instance, if a department within the firm did not utilize technology on a daily basis, and was required to change their daily tasks to utilize technology, this department was reluctant to transform their tasks to incorporate technology due to fear or unwillingness to learn the new system (Lines, 2004). It is prominent for the organization to investigate and acknowledge the different cultures within the organization and provides the necessary change management strategies to assist the firm with transforming to the new ERP system (Lines, 2004; Schniederjans & Yadav, 2013).

ERP systems have shown continued improvement and value for organizations that have been able to successfully implement such large systems (Häkkinen & Hilmola, 2008). The purpose of these systems is to build a true enterprise software environment within an organization, combining both physical and system processes, workflows, and entities into a single reusable system (Sutherland, 2003). This is a large task and one that requires complete acceptance within the organization to receive the expected outcomes.

Traditionally, only large organizations have invested heavily into ERP systems for two reasons. First, the packages available on the market are designed for large organizations with the resources to handle implementation and manage the system throughout its life, while only recent changes have provided packages designed exclusively for smaller organizations (Chen, 2001). Second, the investment required of time, money, and human resources are daunting and prevent small organizations from being able to consider such systems (Hidalgo, Albors, & Gómez, 2011). Regardless, the complexities that large organizations usually experience are often adaptable within modern ERP packages. In most cases, the ERP packages are essentially business platforms that allow the organizations to design and build systems and processes that rely on the ERP platform (Avram, 2010).

Large organizations benefit from ERP implementations by centralizing information and controlling processes and workflows within the organization (Dezdar & Ainin, 2010). They have added benefits of real-time visibility of their inventory levels and production outputs among others. From a socio-technical

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perspective, this centralization of information and control of processes are critical for the organization to reduce process sprawl and ensure that everyone within the organization utilizes similar processes and workflows where applicable (Shah, Bokhari, Hassan, Shah, & Shah, 2011).

ERP could be a risky tool for any organization and the demands it places on the organization, its employees, suppliers, and consultants can end disastrously. Several high-profile organizations have executed successful ERP implementations, such as FedEx and Home Depot, while others such as Fox Meyer filed for bankruptcy in the midst of implementing its system (Huang, Chang, Li, & Lin, 2004). Often forgotten with ERP implementations is that the software is supposed to serve as a tool. However, organizations must adapt processes to allow integration of the new ERP software and the newly defined processes. This knowledge is important to the implementation, especially at the large organization scale, as it requires massive retraining and acceptance testing to ensure the organization is ready to handle the shift in process and technologies.

Regardless of the potential benefits and success stories surrounding ERP systems, the reality is that most implementations end in failure or diminish the organization. The literature surrounding ERP has become quite extensive over the years. The original literature aimed to discuss the purpose and benefits of the systems, while later literature has identified the implementation concerns and problems. The current literature focuses on the challenges in all phases of implementing ERP systems from the decision to the implementation, maintenance and sustained use of the ERP system.

Critical Success Factors (CSFs) for ERP Implementation

One of the existing problems was the decision to implement ERP systems without fully identifying specific critical success factors (CSFs). As organizations continue to implement new technology solutions to meet customers' needs and to conduct a more effective best practice, it is paramount for those companies to incorporate factors based on the success of other organizations. CSFs were critical elements required for an organization or business to be successful when an ERP system implementation had achieved its mission of installation. To allow the business to continue operation and reach future achievements, CSFs have been explored from a wide variety of fields, which include IT infrastructure, ERP, Software Development and Implementation, and IT decisions. Many researchers have devoted efforts to explore CSFs in ERP implementation over the decades. A chronological review of major literature on CSFs is followed.

Bullen and Rockart (1981) studied CSFs within organizations and described CSFs as the major areas of activity required for organizations to meet their objectives. Bullen and Rockart (1981) explained the need for organizations to comprehend the significance of defining these CSFs for setting more strategic objectives. Although the need to understand the importance of interviewing to gather CSFs was paramount, so was the need to understand the basic definitions of strategy, objectives, goals, measures, and problems (Bullen & Rockart, 1981). By defining these specific areas, Bullen and Rockart (1981) discovered the differences within the organization, and the CSF prioritization disparities; the CSFs were different for each area and prioritized based on their departmental requirements depending on the department.

To determine where the prioritization disparities existed, it was imperative to break the CSFs into more manageable sectors. Slevin and Pinto (1987) examined the need to balance CSFs within two categories: strategy and tactics. According to Slevin and Pinto (1987), 29 organizations should incorporate factors both at the beginning of a venture (strategic) and toward the last stage of a project (tactical). These two categories should continuously interact throughout the lifecycle of the project. By combining the two

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classifications, there was a higher probability of reducing errors associated with only incorporating one category over the other (Slevin & Pinto, 1987). Similar considerations are imperative when implementing ERP systems.

Holland and Light (1999) categorized the factors into two sectors (i.e., strategic and tactical) and incorporated it with ERP implementations. The CSF research framework identified in Slevin and Pinto's (1987) study allowed Holland and Light (1999) to streamline the process to incorporate ERP projects. Holland and Light (1999) defined tactical factors to involve business vision, ERP strategy, legacy systems, project schedule/plans and top management support by incorporating the definitions from Pinto's and Slevin's (1987) study. In addition, Holland and Light (1999) noted that tactical factors should include personnel, client discussions, client acceptance, business procedural changes and software configuration, monitoring and feedback, and communication. In Holland and Light's (1999) study, solidifying the need to incorporate both strategic and tactical factors when implementing an ERP system is not an easy task. Many researchers have devoted much effort to explore CSFs during the next two decades.

Somers and Nelson's (2001) list of CSFs by degree of importance in ERP implementation consisted of 22 items: top management support, project team competence, interdepartmental co-operation, clear goals and objectives, project management, interdepartmental communication, management of expectations, project champion, vendor support, and careful package selection, data analysis and conversion, dedicated resources, steering committee, user training, education on new business processes, BPR, minimal customization, architecture choices, change management, vendor partnership, vendor's tools, and use of consultants. Akkermans and van Helden (2002) described how one list of CSFs (from Somers and Nelson, 2001) was used to analyze and explain project performance in an ERP implementation in the aviation industry. They described how a poor project performance led to a crisis but later it was turned around into a success. The top ten list of CSFs that was found helpful and appropriate in explaining both the initial failure and the final success of the implementation include: top management support, project team competence, interdepartmental co-operation, clear goals and objectives, project management, interdepartmental communication, management of expectations, project champion, vendor support, and careful package selection (Akkermans & van Helden, 2002). These are all important CSFs for ERP implementation.

Cao (2006) conducted a quantitative study on CSFs on the software development project and identified three critical success factors for Agile software development: Delivery Strategy, Agile Software Engineering Techniques, and Team Capability. This study is focused on software development and it's not focused on software installation and infrastructure required for software installation. Plant and Willcock (2007) summarized CSFs in an international realm based on a case research approach defined by seminal research. During such inquiries, researchers should be able to agree upon the mean rankings of CSFs by importance of ERP implementation.

Over the years, more CSFs were investigated by researchers. For example, Finney and Corbett (2007) conducted a study to compile and analyze how specific CSFs impacted ERP implementation through CSF 30 compilation strategies; they revealed 26 CSFs based on the categorization defined by Slevin and Pinto (1987) and Holland and Light's (1999) CSF model for EPR implementation. Finney and Corbett (2007) summarized that CSFs consisted of two categories: strategic (i.e., visioning and planning, top management commitment and support, implementation strategy and timeframe, project champion, vanilla ERP, change management, project management, and managing cultural change) and tactical (i.e.,

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empowered decision makers, and software configuration and business process re-engineering BRP). However, those CSFs categories were similar to previous researchers' study findings.

Worell (2008) focused on running the ERP marathon to enhance ERP-business to fit in the post-implementation phase. He suggested that common knowledge and liaison mechanisms are more critical to knowledge integration than are structural arrangements, and that knowledge integration is more important for organizational capabilities aimed at achieving change and innovation, rather than compliance and control (Worell, 2008). Patricia (2010) conducted the research to study the quantitative correlation of enterprise resource planning type, success, and technology leadership style in local government, and found that there was a relationship between leadership style and type of ERP implemented as well as perceived ERP success in local government.

Abayomi (2013) examined accounting and stock market measures in evaluating the impact of returns on investments in information technology on corporation performances. He found that IT expenditure was positively associated with profitability, productivity, efficiency, and coordination, and most accounting and financial professionals as well as academicians utilized accounting and stock market performance measure tools in appraising return on IT investments (Abayomi, 2013). This study does not support any specific tools of accounting and stock market performance measure, so there is a gap of identifying these tools and ranking them according their effectiveness.

Godwin (2014) conducted the study about the leadership efficacy during enterprise resource planning implementation process and found the eleven leadership traits in the order of most influential during ERP implementation. According to Godwin (2014), these traits cannot be applied on future leadership traits because researcher believed that leadership traits change as the environment changes. Pabst (2015) conducted the study on failed return of investment with ERP in small businesses to explore the factors for ERP failure and to understand the model for ERP implementation.

Ali and Miller (2017) believed that ERP implementation brought with it a set of challenges. They found that the top three important critical success factors during the implementation included top management support, good project management teams, and good communications (Ali & Miller, 2017). Reitsma and Hilletofth (2018) evaluated critical success factors for the implementation of an enterprise resource planning system from a user perspective. They found 13 CSFs important and they classified the most important factors as project team, technical possibilities, strategic decision-making, training and education, minimum customization, software testing and performance measurement (Reitsma & Hilletofth, 2018). Two of the 13 CSFs that are not important when implementing an ERP system included organizational change management and top management involvement (Reitsma & Hilletofth, 2018). Although many researchers have explored ERP implementation and have come up with various CSFs, they did not disclose any direct references to investigate CSFs in the implementation of ERP in organization located in Phoenix area.

MAIN FOCUS OF THE CHAPTER

The purpose of this study was to explore the perceived critical success factors (CSFs) in the implementation of ERP system from fifteen IT professionals and administrators in a Phoenix company. The central research question was: What are the critical factors in the implementation of ERP system in a Phoenix company? Three sub-questions were used to guide this study: (a) How do company administrators define

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the critical factors for the effective implementation of the ERP on the management and information system development of a company? (b) How do company administrators perceive the influence of critical factors on the effective implementation of ERP in a Phoenix company? (c) Why do company administrators perceive those factors as critical and successful to the management of ERP in a Phoenix company?

This study adopted a qualitative method with a case study design. This intrinsic case study has been designed to obtain the experience and perceptions of the participants regarding ERP program. Fifteen participants who were IT professionals and administrators within the selected phoenix firm were selected to participate in the face-to-face interviews. The participants' ERP experience ranged from 5 year to 20 or more years for the primary study. To ensure no ambiguity and bias in the interview questions, field test was conducted with three participants after obtaining Institutional Review Board approval.

In this study, the CSFs for successful ERP implementation are based on Finney and Corbett's (2007) study. The "Strategic Critical Success Factors" included: (a) top management commitment and support; (b) visioning and planning; (c) project champion; (d) implementation strategy and timeframe; (e) vanilla ERP; (f) project management; (g) change management; and (h) managing cultural change. Tactical Critical Success Factors involved: empowered decision makers and BPR and software configuration (Finney & Corbett, 2007). This research attempts to bridge the gap by exploring the CSFs for ERP implementation from IT professionals in a company in Phoenix, Arizona, since ERP has been very important to the organization for multiple applications. Incorporating ERP system allows companies to store data at one central location. Knowledge of this research would assist leaders of the organization to make better decision regarding the ERP investment and implementation.

The major findings are illustrated as follows. According to the 15 participants' interview responses, using ERP system at various firms can be categorized into three phases: many issues, no issues and good experience, and both good and bad experience. Nine participants perceived critical success factors (CSFs) for implementation of ERP to include top management commitment and support, managing cultural change, BPR and software configuration, ERP Package, Implementation strategy, project management, and training. Five participants believed that the main CSFs were: vision and planning, project champion, and empowered decision maker. One respondent perceived that only one CSF is important; that is, change management program.

In the relationship between the CSFs and management and information system development of the firm, 11 participants believed that implementing ERP is very important and those CSFs will assist their firm to save money and time. The effect of CSFs on the successful implementation of ERP included two types: well perceived for the implementation ERP and effective for excellent implementation. They believed that CSFs are important for successful implementation because they increase efficiency, better reporting, customer service, security, integrated information, and better management as endorsed by 14 participants. One respondent noted that expected output and fewer complains were the reasons. As to the support for CSFs from the management, 12 participants believed that there was enough management support and three participants claimed that support is not enough and ERP team needs more support.

Issues, Controversies, Problems

Significant emergent themes were identified based on the reoccurrence of the themes across the interview responses. These emergent themes revealed some issues and problems in implementing ERP systems. In the following, major issues and problems were illustrated and discussed.

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Employees Have Insufficient Training

Insufficient training was identified as the first emergent theme. Lack of training is the major issue for not implementing ERP system successfully, and this theme was concluded by most of the participants in this case study. Training is a major factor for successful ERP implementation, because training is connected with management and information technology department. According to the participants, training will assist employees in increasing efficiency, better reporting, better customer service, better security, and integrated information. The participants believed that they cannot do well unless there are training sessions provided to them by the company.

Investment of Protection Costs Money

The second emergent theme was related to the cost of the investment protection. Will the company benefit from the investment of implementing ERP systems? Whenever a firm is implementing ERP system, it requires a lot of investment financially because ERP system integrates all the other systems located in various departments. The participants believed that any factor mentioned in this research has an impact on the implementation of ERP. If ERP implementation is successful, then all the investment will generate more money, and the company will be able to save money on investment. According to the respondents, these CSFs have been linked to management and Information technology department. Through the proper use of these CSFs, money can be saved on investment. Otherwise, like many organizations, all the investment done on research is a waste. Support of the management is the key factor in money saving because managers do not want to make an investment to which company does not has any profit. All the investors in the company look at the return on investment (ROI) factor before conducting any research. Generating ROI means saving for the company and the investment is more protected.

Implementing ERP System Is Time-Consuming

The third emergent theme is that it is time-consuming during the ERP implementation process. Implementing ERP system in the organization is not an easy process. Are they willing to sacrifice so much time in implementing ERP systems? Respondents from this study believed that time can be saved if proper critical success factors can be identified and implemented immediately. Time can be saved if the company knows how to use the factors effectively while the ERP is being implemented. Some respondents agreed that if company can make decision on ERP investment and stop proceeding of the ERP implementation at early stage, a lot of time could be saved. According to the respondents, time can be saved even after implementing ERP through the higher efficiency and better production.

Varied Critical Success Factors Need to Be Considered

The fourth emergent theme is that Critical Success Factors (CSFs) are varied and many. All IT professionals agreed upon the importance of CSFs for successful implementation of ERP, and the top important factors are: management commitment and support, managing cultural change, business process re-engineering (BPR) and software configuration, ERP Package, implementation strategy, project management and training. The top management and various administrators are supporting CSFs for effective implementation

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of ERP to achieve the expected outcomes. However, the procedures for implementation take longer than expected. Many respondents believed that these CSFs cover all areas of the firm and these CSFs make ERP implementation successful, which lead to effective management of the company. These CSFs also assist organization to solve many management issues indirectly because CSFs lead to successful ERP implementation and successful ERP implementation assist in solving management issues; however, not every company consider them seriously.

Expected Output or Outcomes Are Not Achievable Without ERP

The fifth emergent theme is that the expected outcomes are not achievable without ERP. IT professionals strongly believed that with the successful implementation of ERP, expected outcomes or objectives of having ERP would be achieved. These outcomes are increased in efficiency, better reporting, improvement in the customer service, better security, and more integrated information system. Since expected outcomes are not achievable without successful ERP implementation, successful ERP implementation completely depend on the consideration of CSFs (i.e., top management commitment and support, managing cultural change, business process re-engineering (BPR) and software configuration, ERP Package, implementation strategy, project management and training). In other words, the issue is that not every company embraces those factors for ERP implementation. Some critical factors might not be executed in ERP implementation.

SOLUTIONS AND RECOMMENDATIONS

IT leaders have the power to execute policies and to implement the ERP systems. Effective implementation of ERP systems in any organization is beneficial because the company has competitive advantages with the assistance of this technology. Based upon the findings, the following recommendations were generated for IT leaders in regards to the use of CSFs for effective implementation of ERP system in a company within the Phoenix area.

1. IT leaders should always consider the use of CSFs for effective ERP implementation. CSFs can be differed depending on the types and nature of the organization as well as the culture of the organization. The leaders should examine and evaluate the effects of CSFs from different companies for the implementation of ERP systems.
2. IT leaders should create the goals and maintain a mission for using CSFs for effective ERP implementation. The goals should match with the organization's mission. A program that is aligned with a mission will ensure that the CSFs are being used effectively for effective ERP implementation. The establishment of the mission would create a mentality of seriousness among team members that allows for the IT institution staff and administrators to take the CSFs seriously as a step in the implementation of ERP system.
3. IT leaders should select a CSFs supervisor that can establish a caring, therapeutic, and positive environment. The supervisor should be able to maintain this type of environment for all employees and report directly to the institution's administration. The supervisor serves as the leader in ERP implementation who look after the procedures and the success of the production.

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4. IT leaders in all organizations should include CSFs guidelines that can be used for the effective implementation of ERP. These CSFs would assist in guiding employees to use CSFs for effective ERP implementation. Training is needed to help employers to watch for CSFs and to help employees adjust to the systems.

FUTURE RESEARCH DIRECTIONS

The major limitation of this case study is the small sample size. The small sample size restricts the study to generalize the findings to a larger population. The use of open-ended interview questions and interviewer notes required participants to provide detailed responses that are honest and dependable. If the participants did not provide responses to the interview questions of this study truthfully, their answers might have impacted the findings of this case study.

Based on the research findings, there are five recommendations for future researchers. First, the modification of the research method to mixed methods from the qualitative method is recommended. The use of mixed methods approach would allow the researchers to collect both quantitative and qualitative data. As a result, a more holistic view of the CSFs for effective ERP implementation in Phoenix firm may be better obtained. Second, the modification of the research design from an intrinsic case study to a phenomenological study is recommended as well. With a phenomenological study, the researchers could provide an understanding of how the CSFs impact the ERP implementation through the real-life experiences of the participants themselves. Third, future researchers can also adopt a quantitative study with survey questionnaire to explore more CSFs from various companies in different cities and states, or to investigate the impact of SCFs in varied companies in the United States. The investigation of CSFs used in ERP implementation in companies in foreign countries is recommended as well. Fourth, a modification of geographic location is needed. The geographic location can be broadened to include multiple firms within the state or focus on urban and rural companies. Fifth, a modification of participant demographics to include broader range of IT professionals, business leaders, IT administrators, and other employees in various companies. This modification may provide a deeper understanding of CSFs for effective ERP implementation through multiple stakeholder group's perspectives in the country.

CONCLUSIONS AND DISCUSSION

ERP has been considered as robust system for companies because it enhances cross-functional adeptness by integrating data drifting through the organization and connects all sectors to increase the cohesiveness among the departments. With the ERP system, the company was able to incorporate a more cross-functional capability. Since ERP implementation from the management perspective for the company located in Phoenix is not working well and the company is not receiving expected outcomes, this study explored the perceived critical success factors in the implementation of ERP system from 15 IT professionals and administrators in a Phoenix company.

Five major themes emerged in this study (i.e., insufficient training, the cost of investment protection, multiple CSFs, expected outcomes not achievable, and time-consuming features). In comparing literature with current study, several findings were surfaced. First, insufficient training has become an

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issue in effective ERP system implementation. The finding of this study is inconsistent with the finding of Fulton's (2015) study. The finding of this study provides that training is one of the CSFs for effective ERP implementations; however, in Fulton's (2015) study of CSFs for effective ERP implementation, training was not mentioned as one of the CSFs for successful ERP implementation. Instead, Zouine and Fenies' (2014) findings proved that training is a critical success factor for ERP implementation.

As to the protection of investment, the finding of this study is consistent with Fulton's (2015) study that successful ERP implementation is dependent on the CSFs and CSFs assist in saving investment by making ERP implementation effectively. Zouine and Fenies' (2014) findings also support the consideration of CSFs for effective ERP implementation and it leads to saving of investment. Additionally, the finding of time-consuming is consistent with Pabst's (2015) and Patricia's (2010) studies of CSFs for effective ERP implementation. The ERP system helps companies save time because of the increase of efficiency. If ERP has not been implemented successfully, the time spent on implementing ERP will be wasted.

Next, CSFs are crucial for ERP implementations. This study supports the importance of CSFs and is consistent with the following researchers' findings (e.g., Aldawani, 2001; Bullen & Rockart, 1981; Curko et al., 2012; Kavanagh & Ashkanasy, 2006; Lines, 2004; Maleki & Anand, 2008; Martin & Huq, 2007; Nikolaou et al., 2007; Plant & Willcocks, 2007; Shaul & Tauber, 2013; Todnem, 2005; von Urff Kaufeld et al., 2009). Fulton's (2015) study findings showed that the important CSFs are top management commitment and support, managing cultural change, BPR and software configuration, ERP Package, implementation strategy, project management, Vision and planning, project champion, empowered decision maker and change management program. These CSFs are also supported by this study.

Additionally, the findings of expected outcomes are consistent with previous studies (i.e., Fulton, 2015; Pabst, 2015; Patricia, 2010; Zouine and Fenies, 2014) in that whenever ERP has been successfully implemented, the expected outputs have been achieved. The success of ERP implementation is completely depending on the all the achievable outcomes. There are no studies about CSFs that do not support expected output. Twelve participants agreed that top management and various administrators have perceived these factors as supporting CSFs for effective implementation of ERP to achieve expected outcomes.

The major critical success factors for ERP implementation involved top management support, teamwork and composition, effective communication, clear vision and planning, data quality and integrity, project management, change management, training, and business process re-engineering. All participants agreed that these CSFs are connected to management and information system through the ERP system because these CSFs make ERP implementation easier and the ERP system assists everyone in the company. All participants understood that without CSFs, ERP implementation would not be successful and effective. IT professionals and administrators perceived these CSFs beneficial in saving time and money because of successful ERP implementation.

Additionally, the participants revealed that the top management commitment and support, managing cultural change, BPR and software configuration, ERP Package, Implementation strategy, project management, and training as important CSFs for effective ERP implementation. They believed that these CSFs cover all areas of the company and these CSFs make ERP implementation successful, which lead to effective management. CSFs assist organization in solving many management issues indirectly, because CSFs lead to successful ERP implementation. Based on the findings, IT leaders should use various CSFs and these CSFs are upper management pledge and care, managing cultural alteration, BPR

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and software configuration, ERP Package, Implementation strategy, project management, and training. The CSFs would assist and provide resources to reduce ERP failure.

It is recommended that various organizations will be using the critical success factors in the implementation of ERP. ERP has been predominent to many organizations for utilizing multiple applications. As mentioned earlier, incorporating ERP system allows companies to store data at one central location. However, it is very important for the administrators and IT professionals to comprehend the link between critical factors and the success or failure of ERP integration. Knowledge of this research would assist leaders in the organizations to make better decision regarding the ERP system investment. CSFs are essential for the effective implementation of ERP system. Implementing ERP system without the considerations of CSFs will not generate the expected outcomes for the companies, and it will waste money and time for ERP investment.

As to the trends for ERP implementation, researchers have predicted for ERP to be game-changers. Pohludka, Stverkova, and Ślusarczyk (2018) claimed that the enhancements like an assistive and conversational user interface will become a primary differentiator in the selection of many ERP systems and associated applications, and these interfaces and their underlying intelligence are the differentiating qualities that will profoundly distinguish their system identity. There is no doubt that, among ERP producers and their customers, the digital transformation of the economy is reshaping many software applications. As Gheorghiu (2017) indicated, systems that use new technologies (e.g., machine learning, cloud deployment and predictive analytics) to manage data will become industry leaders and, sooner than later, the norm. In considering what and how CSFs influence ERP implementation, we should also pay attention to the impact of technology innovation to the organizations in future.

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KEY TERMS AND DEFINITIONS

Change Management: The approaches, techniques, and procedures that support or assist employees in an organization to make change to reach the organization goals.

Critical Success Factor (CSF): Critical elements required for a business or an organization to be successful while implementing ERP system.

Enterprise Resource Planning (ERP): An integrated information system that serve all departments within an enterprise.

Leadership Techniques: Leadership styles that were adopted by company leaders to increases efficiency, satisfaction, development, and advancements in all conditions in the organization.

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Strategic Critical Success Factors: Factors that assist ERP implementation, such as top management, commitment and support, visioning and planning, project champion, implementation strategy and timeframe, vanilla ERP, project management, change management, managing cultural change.

Tactical Critical Success Factors: Factors that assist ERP implementation involve empowered decision makers, BPR, and software configuration.

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Chapter 12
Application of Utility Mining in Supply Chain Management

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ABSTRACT

Supply chain management (SCM) assumes an exceptionally indispensable part in overseeing and sorting out big business forms, expanding operational productivity of the association. Inventory management is turning into a need to enhance the establishment and framework inside social orders which thusly builds the financial development. The examination discoveries demonstrate that despite the fact that it appears that SCM gives numerous administrations, it has a few issues as well including poor stock administration, bullwhip impact, high cost of coordination, innovation use, and lacking interest in IT. To beat issues of SCM, there is need of an enhanced sales forecasting model that will build the reliable and efficient forecasting results. An enhanced sales forecasting model is presented in this chapter.

INTRODUCTION

The idea of supply chain rose during 1980 and since has been generally utilized by scholarly specialists and modern specialists are still in a creating procedure. The supply chain management (SCM) execution in an assembling association accomplishes upper hand and key fit over other assembling associations. A supply chain incorporates every one of the exercises, capacities and offices associated with the stream and change of merchandise and enterprises from the material stage to the client (Chopra & Meindl, 2013). The SCM help in decrease in the stock, precise data sharing and create trust among the supply chain accomplices (Lee, Chu, & Tseng, 2011). Yet, in spite of these imperative advantages, associations keep on experiencing a boundary which ruins them from viable usage of supply chain. These boundaries are known as supply chain management hindrances. They exist among inside and outside of assembling association. indistinct association objective, lack of best administration responsibility and support, short-term basic leadership points of view, lack of data innovation, poor ICT structure, lack of instruction and preparing to representative and provider representative, lack of important instruments administration

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abilities and absence of inspiration and worker contribution are some of boundary exist inside assembling association while protection from change, absence of estimation framework, reluctance to share data among supply chain partner, an absence of between hierarchical participation and coordination are obstruction outside assembling association(Cavinato, 1992; Cooper, Lambert, & Pagh, 1997). Supply chain management is the fundamental and critical piece of association to expand the benefit of the association. Viable supply chain management has turned into a possibly compelling approach to anchoring upper hand and enhancing association execution (Li, Rao, Ragu-Nathan, & Ragu-Nathan, 2005). The supply chain management is a capable instrument for an endeavour to bring down costs, increment incomes, accelerate turnover and improve centre competency (Du, Wong, & Lee, 2004). In any case, it is notable that gigantic data has been created and put away on each hub of the entire inventory network, which is expanding tremendously like a snow slide. Facing such gigantic data, it is troublesome for an undertaking to discover out the standards amongst providers and clients on the premise of its own business information, and afterward examine and settle on choices as needs be as previously. Without a intense apparatus for information investigation and handling, it is unrealistic for nodal enterprises in the supply affix to process the data in time, nor can they utilize the data to respond rapidly and correctly. On the off chance that nodal ventures neglect to build up their own centre competency, it will arouse the entire supply chain (Autry & Bobbit, 2008).

Further, there are three fundamental issues in supply chain management. The principal issue is supply chain integration. The general understanding of the business environment in most industries is that competition has increased and the conditions under which business is made are more turbulent. Supply chain integration challenges can be classified through the challenge of system relationships; the supply chain management system has two kinds of relationships, which are the relation between sub-systems, and the relationship between supply chain management system and the business strategies, this classification emphasizes the technical challenges that came from the relationbetween supply chain management system and internal business strategy, unfortunately this classification bypass the challenges that the companies may face from external environment. The second issue is quick changing markets. To start with, items have shorter life cycles because of quickly changing business sector requests. Ventures are experiencing strain to stay aware of the most recent patterns and advance by presenting new items, while keeping their aggregate assembling costs low since they comprehend that patterns won't keep going for quite a while. This likewise requests an adaptable inventory network that can be used for assembling different items and for future ventures. Second, beside new items, organizations additionally need to continually refresh item includes. Upgrading item includes expects ventures to overhaul their supply chain to suit item changes. The third issue is quality and compliance. Item quality frequently runs as an inseparable unit with consistence. Undertakings need to guarantee that they meet neighborhood and global administrative models in assembling, bundling, dealing with, and delivery of their items. Besides breezing through quality control and wellbeing tests, undertakings are likewise required to plan consistence records, for example, grants, licenses, and affirmation which can overpower them and their supply chain management systems. The issue in supply chain management is whether the data in the chain can be examined and prepared in time and regardless of whether the obtained learning and decision information can be exchanged to each nodal enterprise and association without block (Gaonkar &Viswanadham, 2007). Data mining techniques can look models in the information base, rapidly and naturally discover the models also, valuable data covered up in the information, and help clients comprehend reasons and make expectations. The endeavour can examine and process the huge relative information amassed in the

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inventory network, for example, logistics, information flow, fund flow, and so on (Shankar, 2009). It is unavoidable to remake the task and information flows within the enterprise or among endeavors during the foundation of the supply chain. With the method of variance analysis in data mining, the enterprise can examine and process different information data to discover the existed issues in the flows, thus to establish a strong framework for the development of supply chains (Stock, Boyer, & Harmon, 2010). The issue in supply chain management, in the final analysis, is whether the data in the chain can be examined and prepared in time and regardless of whether the obtained learning and choice in arrangement can be exchanged to each nodal enterprise and organization without obstruction. Data mining technology can look models in the database, rapidly and naturally discover the models and valuable data covered up in the information, and help clients get reasons and make expectations. The enterprise can investigate and process the gigantic relative information accumulated in the supply chain (Bao, & Zhang, 2004). As the supply chain is essentially a virtual enterprise framework among enterprises and markets, different risks from all parties exist in the supply chain. Data mining can help separate their characteristics according to a lot of verifiable measurement data from each nodal enterprise or organization in the supply chain and make analysis to provide a target assessment on these partners (Coenen, Leng, Goulbourne, 2004). The results will be exhibited after induction and summary, in order to limit the risks in the supply chain. As another sort of data handling innovation, utility mining with its capable capacity of information investigation and handling will play an important part in supply chain management (Aloini, Dulmin, Mininno, & Ponticelli, 2012).

Further, inventory management is basically about distinguishing the sum and the situation of the merchandise that a firm has as inventory. Further, for some inventory items, the criteria, (for example, the cost of an item) are gotten not just from themselves, yet in addition from their impact on the criteria of different items, for the most part called the "cross-selling effect" characterized by Anand, Hughes, Bell, & Patrick (1997). In this way, items ought to be arranged while thinking about such connections. The ABC order is utilized for positioning all inventory items on the thought of benefit in light of historical transactions (Flores & Whybark, 1987; Lenard, & Roy, 1995). However, cross-selling effect isn't considered while positioning things in conventional ABC order. Brijs, Swinnen, Vanhoof, & Wets (1999, 2000) built up a PROFSET demonstrate by considering cross-selling effect among items. They computed the benefit of a frequent item set. In any case, the PROFSET demonstrate does not think about the quality of connection between items. The PROFSET show does not give relative positioning of chosen items, or, in other words order of inventories. In addition to compute the benefit of a successive item set the maximal frequent item set had been utilized. In any case, the maximal frequent item set regularly does not happen as often as possible as its sub-sets. In this manner, the PROFSET show can't be utilized to arrange inventory items. Kaku (2004) arranged inventory items in view of quality of connection between things. Kaku & Xiao (2008), additionally expanded inventory order considering cross-selling effect and ABC arrangement. They led trials to demonstrate that an impressive extensive piece of inventory items change their positions in the ranking list of importance. However, they have not considered that whether and how the quality of association with connected items impacts such positioning methodology. Xiao, Zhang, & Kaku (2011) arranged inventory items which are associated each other utilizing the idea of cross-selling effect together with ABC arrangement and loss profit. They grouped items dependent on loss rule (Wong, Fu, & Wang (2003, 2005)). The loss profit of item/item set is characterized as the paradigm for assessing the importance of item, in view of which inventory items are arranged. They explained that to judge the importance of an item (set), it is not only by looking at

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the profit it brings in when it is on the shelf, but also the loss profit it may take away when it is absent or stock out. However, they have not classified items in considering the utility of items. Further, mining high utility item sets from the databases isn't a simple errand since the downward closure property (Agrawal & Srikant, 1994; Agrawal, Imielinski, & Swami. 1993; Huang, Dai, & Chen, 2007) utilized as a part of frequent item set mining can't be connected here. In other words, pruning look space for high utility item set mining is troublesome on the grounds that a superset of a low utility item set might be a high utility item set. Existing investigations connected overestimated strategies to encourage the mining execution of utility mining (Ahmed, Tanbeer, Jeong, & Lee, 2009; Chan, Yang, & Shen, 2003; Li, Yeh, & Chang, 2008; Liu, Liao, & Choudhary, 2005; Yao, Hamilton, & Geng, 2006). In these techniques, potential high utility item sets are discovered to begin with, and after that an extra database examine is performed for recognizing their utilities.

In this paper, utility mining is used to find profitable items. Further, the loss profit is calculated for each item. Thus, inventory manager can focus on beneficial things and keep up required stock. The learning acquired from such beneficial happening items can be utilized by a grocery store to overhaul the format of the store. This builds the benefit by setting interdependencies items close to each other and henceforth fulfills clients through sparing time and helps in supply chain management. This model will fill the gap in the implementation of technologies in Industry 4.0 within the supply chains. Supply chains could be more readily controlled when there is data at every level of the manufacturing and delivery process. Computer control could produce much more reliable and consistent productivity and output. And the results for many businesses could be increased revenues, market share, and profits.

BACKGROUND

In this section, we review several topics: Role of data mining in supply chain management, utility mining, and loss profit with cross-selling.

Role of Data Mining in Supply Chain Management

Supply chain involves the stream of items, data, and money. In traditional supply chain management, business forms are separated from stock control and, subsequently, stock is the immediate yield of deficient data. The focal point of contemporary supply chain management is to sort out, plan, and actualize these streams (Marvin, Brown &John, 2003). To start with, at the organizational level, items are produced, transported, and put away dependent on the clients' needs. Second, planning and control of component production, storage, and transport are managed using central supply management and replenished through centralized procurement. Third, the usage of the supply chain includes the whole cycle from the request passage procedure to arrange satisfaction and delivery. Further, the supply chain cost is hugely influenced by the excess or shortage of inventories (Radhakrishnan, Prasad, & Gopalan, 2009). Since inventory is one of the major factors that affect the performance of supply chain system, the effective reduction of inventory can substantially reduce the cost level of the total supply chain (Biswas & Narahari, 2004). Thus, inventory optimization has emerged as one of the most recent topics as far as supply chain management is considered (Rodrigues et al., 2008). Data mining can create a better match between supply and demand, reducing or sometimes even eliminating the stocks (Neaga & Harding, 2005).

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Data mining thus has turned into an essential instrument in seeing needs, inclinations, and practices of clients. It is additionally utilized in evaluating, advancement, and item improvement. Traditionally, data mining procedures have been utilized in banking, protection, and retail business. This is generally a direct result of the way that the execution of these methods indicated snappy returns. Data mining is being utilized for client profiling where attributes of good clients are related to the objectives of foreseeing new clients and helping showcasing divisions target new prospects. The viability of offers sales promotions/ product positioning can be dissected utilizing market-basket analysis to figure out which items are acquired together or by a person after some time, which items to stock in a specific store, and where to put items in each store (Raisinghani & Medea, 2005). The hidden knowledge obtained through Data mining becomes essential to support decision-making in supply chain tasks (Beamon, 1999). Further, utility mining is considered for finding frequent items considering utility of items.

Utility Mining

In real-world applications, transactions for the most part contain the benefits and amounts of items. Some high-benefit items may rarely occur in a transaction database. Item mixes with high benefit yet low recurrence may not be discovered utilizing association-rule mining approaches. To address this issue, Chan *et al*. (2003) proposed another examination issue named utility mining, which considered the amounts of items as well as their benefits in a set of transactions. By utilizing these two sorts of data, the genuine utility of an item in a database can be all the more precisely perceived contrasted with that got utilizing conventional association-rule mining, which only considers the frequencies of items.

Utility mining is a standout amongst the most difficult data mining tasks is the mining of high utility item sets effectively. Identification of the item sets with high utilities is called as Utility Mining. The utility can be estimated according to the client inclinations utility can be estimated as far as cost, benefit or different articulations. The constraints of regular or uncommon item set mining spurred scientists to imagine a utility based mining approach, which enables a client to advantageously express his or her points of view concerning the convenience of item sets as utility qualities and after that find item sets with high utility qualities higher than a threshold. In utility based mining the term utility alludes to the quantitative portrayal of client inclination i.e. as per an item sets utility esteem is the estimation of the significance of that item set in the client's viewpoint.

Yao, Hamilton, & Butz (2004) characterize the issue of utility mining formally. The work characterizes the terms transaction utility and external utility of an item set. The numerical model of utility mining was then characterized dependent on the two properties of utility bound and support bound. The utility bound property of any item set gives an upper bound on the utility estimation of any item set. This utility bound property can be utilized as a heuristic measure for pruning item sets at beginning periods that are not anticipated that would qualify as high utility item sets. Yao et al. (2006) characterizes the utility mining issue as one of the instances of constraint mining. This work demonstrates that the downward closure property utilized in the standard Apriori calculation and the convertible requirement property are not specifically appropriate to the utility mining issue. The authors likewise present two pruning methodologies to diminish the expense of discovering high utility item sets. There are many forms of utility mining. Some of them are:

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1. On-shelf utility mining is one of the types of utility mining. It is not just individual benefit and amount of every item yet in addition on-shelf periods in a database. It incorporates on-shelf time of items kept on the presentation. These aides in distinguishing very beneficial items specifically season. Such examples of the items can be recovered utilizing utility mining. Several studies (Hu & Mojsilovic, 2007; Lin, Lan, & Hong, 2012;Li et al., 2008; Liu & Qu, 2012; Tseng, Chu, & Liang, 2006;Yao & Hamilton, 2006; Yeh, Chang, & Wang, 2008; Yao et al., 2004) have extended utility mining to various practical problems, such as efficiency improvement of utility mining (Hu & Mojsilovic, 2007; Li et al., 2008; Liu & Qu, 2012; Yao & Hamilton, 2006),incremental process of utility mining (Yeh et al., 2008), and utility mining in stream environments (Tseng et al., 2006). However, these studies (Hu & Mojsilovic, 2007; Lin et al., 2012; Li et al.,2008; Liu & Qu, 2012; Tseng et al., 2006; Yao & Hamilton, 2006;Yeh et al., 2008) did not consider the on-shelf time periods of products in stores. Lan, Hong, & Tseng (2011) then proposed a new issue named on-shelf utility mining, which considered the on-shelf periods of items in addition to the quantities and profits of items. For instance in the winter season, clients more often than not buy jackets and leggings together. The items {overcoats, Gloves} might be not gainful all through the whole database, but rather might be a high utility item set in the winter. Accordingly it keeps up stock amid specific seasons.
2. Negative utility mining: Utility item sets typically consist of items with different values such as utilities, and the aim of utility mining is to identify the item sets with highest utilities. In the past studies, in utility mining, the values of utility item sets were considered as positive. In some applications, however, an item set may be associated with negative item values. Hence, discovery of high utility item sets with negative item value is important for mining interesting patterns like association rules. For example, many super markets may promote certain items to attract customers. In this scenario, customers may buy specific items and then receive free goods. Free goods result in negative value for super markets. However, supermarkets may earn higher profits from other items that are cross-promoted with these free items. This practice is common. For example, if a customer bought three of item 'A', he would then receive one free item 'B' as a promotion from the supermarket. Suppose the supermarket gets five dollars of profit from each unit of item 'A' sold, and loses two dollars for each unit of item 'B' given away. Although giving away a unit of item 'B' results in a loss of two dollars for supermarkets, they could possibly earn 15 dollars from the three units of item 'A' that are cross-promoted with item 'B'. The supermarket thus may have a net gain of 13 dollars from this promotion (Lan, Hong, Huang, & Tseng, 2014).
3. Multi-level mining: Sometimes, at primitive data level, data does not show any significant pattern. But there are useful information hiding behind. The goal of Multiple-Level mining is to find the hidden information in or between levels of abstraction. In this analysis item sets in a market are stored in hierarchy. Level 1 retrieves generic higher level of abstraction of a product. Level 2 applies at a more specific level of abstraction like category. Level 3 applies at the lowest level of abstraction like brand name of a product. For example, instead of finding that Laptop, LCD are high utility items, it is interesting to allow users to drill-down and show Lenovo Laptops and Samsung LCD are high utility items. The association relationship in the latter statement is expressed at a lower level of abstraction but carries more specific and concrete information than that in the former. Therefore, a data mining system should provide efficient methods for mining multiple-level item

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set mining. As per our knowledge, there were no any algorithms proposed so far, to retrieve high utility item sets in multi level data mining.

Utility mining model was characterized to find more essential learning from a database. The significance of an item set is measured by the idea of utility i.e. profit. The data set is handled with non-binary frequency values of each item in transactions and also with different profit values of each item. In this way, utility mining speaks to real market information. By utility mining, a few vital business zone choices like expanding income or limiting advertising or stock expenses can be considered and learning about item sets/clients adding to most of the profit can be found. Such high profit items plays major roles in inventory control (Agarwal, 2017(a), 2017(b),2017(c), 2017(d); Agarwal, Mittal, & Pareek, 2016, 2018). Further, inventory can be better managed if loss profit is considered.

Loss Profit with Cross-Selling

Traditionally, ABC analysis has been based on the criterion of dollar volume and on the principle that there are a relatively small number of items. However, over the last 30 years, there has been an accumulation of research questioning this focus on a single criterion–the dollar volume. Several researchers suggested that multiple criteria should be used in the classification of inventories. However, the problem is that the profit of one item not only comes from its own sales, but also from its influence on the sales of other items or reverse, i.e., the cross-selling effect. Cross-selling effect is defined as the dependency in demand in which a customer buys an item or item-set only when another item or item-set is also in stock (Anand et al. (1997)). To explain the cross-selling effect further let us take an example. In a store, item milk is in the stock and item bread is out of stock. One customer is interested in buying milk, provided bread is also available in the store. Since the demand for milk depends on the demand for bread, he/she will not buy milk, if bread is not available. Hence, in many cases, if bread is not in stock, there will be no sale of milk either. An algorithm for evaluating EOQ while considering cross-selling effect was proposed by Kaku (2004).To represent the strength of relationship between items, a profit ranking approach of items based on a "Hub-Authority" analogy was exploited in Wang & Su (2002). Based on the consideration of the customer behavior that purchasing some items always co-occurs with the purchase of at least one element in non-selected item set, it would be unlikely for these transactions to exist after the selection. So that the total profit of one selection should be given by the original profits of the transactions subtracting the profit loss due to the items removed (not be selected) after making the selection. Such consideration was called loss rule and had been used in the formulation of the total profit of the item (Wong et al., 2003, 2005). The loss rule indicates that the real profit of an item (set) is always less than its self profit because part of the self-profit is brought in by other items that have cross-selling effect with it. Therefore to judge the importance of an item (set), it is not only by looking at the profit it brings in when it is on the shelf, but also the loss profit it may take away when it is absent or stock out (Xiao et al., 2011; Zhang & He, 2002).

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PROPOSED APPROACH

The growth of business databases has created the need for utility mining. The rapid expansion of computer resources has created the potential. Utilizing the potential to fulfill the need has been hampered by a lack of communication between management scientists and computer scientists. This joint effort describes how utility mining can augment traditional management science tools and what we have learned from applying a new utility mining approach to a large-scale, empirical effort aimed at production planning and inventory control. Further, inventory can be better managed, if certain criteria like ABC classification, loss profit, and cross-selling effect etc can be considered. In this section, firstly utility mining is used to find items with high utility. Then the loss profit is calculated for each item. This helps inventory manager to focus on beneficial items and keep up required stock.

The objective of utility mining is to find all item sets whose utility values surpass a user determined limit in a transaction database. In this chapter, utility mining is used to find profitable items, which in turn help in supply chain management. To better understand the concept of utility mining, Let us consider an electronic super store and expect that the benefit of a computer is $3000 and the benefit of a keyboard is $300. In a transaction database, keyboard happens in 10 transactions and computer happens in 3 transactions. The aggregate benefit of keyboard is $30000 and the aggregate benefit of a computer is $9000. According to frequent item set mining keyboard has high recurrence. However, the aggregate benefit of a computer is considerably more noteworthy than a keyboard. Consequently, traditional frequent item-set mining can't find the most productive item sets. This is on the grounds that frequent item set mining does not think about the benefit (i.e. utility) of a thing, which is likewise very vital in decision making. According to utility mining by thinking about benefit, computer has high utility. Generally, utility mining algorithm works as follows:

Stage 1: Consider items from a transaction database.
Stage 2: Calculate Utility for an item set.
Stage 3: Get minimum utility threshold.
Stage 4: Output the high utility item set whose utility is more prominent than minimum utility threshold.

The accompanying are a few definitions to figure utility of item sets (Chokkalingam &Vijayarani, 2016).

Definition 1: In a transaction, the amount of an item is taken as interior utility. For instance, inner utility of item B in exchange T11 is 3 (see Table 1).

Definition 2: In a database, profit is generally picked as outer utility. For instance, outer utility of item A in Table 2 is 2.

Definition 3: The utility of item set S in transaction T is characterized as $u(S, T) = \sum u(ip, T), \forall ip \in S, S \sqsubseteq T$. For instance: utility of item set {B, C} in transaction T31 is

$u(\{B, C\}, T31) = u(\{B\}, T31) + u(\{C\}, T31) = 2 * 3 + 1 * 4 = 10.$

Definition 4: The utility of item set S in database DB is characterized as,

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Table 1. An Example transaction database

Transaction Id	Transactions	Utility of an Transaction
T11	(A,1) (B,3) (C,2)	19
T21	(A,2) (C,3) (D,1)	21
T31	(B,2) (C,1)	10
T41	(B,3) (C,1) (D,3) (E,2)	32
T51	(A,1) (B,3) (C,2) (D,1) (E,2)	28

$u(S) = \sum u(S, T), \forall T \in DB, S \subseteq T.$

For instance, utility of item (A, B) is

$u(\{A, B\}) = u(\{A, B\}, T11) + u(\{A, B\}, T51) = 8 + 9 = 17.$

Definition 5: Item set S is said to be high utility item set if and just if $U(S) \geq$ Min_Util where Min_Util is user specified minimum utility threshold.

Further, the loss profit as given by Xiao et al. (2011) can be summarized in two steps:

Step 1: Generate the cross-selling profit matrix according to formula:

$$M_{JI} = profit(I)confidence(I \rightarrow J)^2 \quad (1)$$

where M_{JI} indicates the profit loss caused by the cross-selling relationship J→I, which can be read as: the cross-selling profit loss of item J from item I when item J is absent (or stock out). In other words, if item J has no cross-selling effect with item I, namely confidence(I→ J) = 0 or less than minimum confidence, then $M_{JI} = 0$; if J is fully related to I, namely confidence (I→ J) = 1, then M_{JI} = profit(I).

Step 2: Calculate the loss profits of every item according to formula

$$Total\ profit(J) = profit(J) + \sum_{I \neq J} M_{JI} \quad (2)$$

NUMERICAL EXAMPLE

Consider the inventory item-set, I = {A, B, C, D, E} and inventory transaction set T= {T11, T21, T31, T41, T51} shown in Table 1. Let us consider the prices of items, A= $5, B= $6, C= $7, D=$8, E=$3. Table 2 shows the utility of each item. Table 3 shows the high utility item-sets.

As per above definitions, high utility item sets are discovered as shown in Table 3.

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Table 2. Utility table

Item	Profit (Utility)
A	2
B	3
C	4
D	5
E	2

Table 3. High utility item-sets

u(A, T11) = 2	u({A,B},T11) = 2 + 9 = 11.	u(A) = 2+4 =6.
u(B, T11) = 9.	u({A,C},T11) = 2 +8 = 10.	u(B) = 9+6+9 = 24.
u(C, T11) = 8.	u({B,C},T11) = 9 + 8 = 17.	u(C) =8+12+4+4=28.
	u({A,B,C}, T11) = 11 + 10 +17 = 38	u(D) =5+15 = 20.
u(A, T21) = 4.		
u(C, T21) = 12.	u({A,C}, T21) = 4 + 12 =16.	u(A,B) = 11
u(D, T21) = 5.	u({A,D}, T21) = 4 + 5 =9.	u(A,C) = 10 +16 =26
	u({C, D}, T21) =12 +5 =17.	u(B,C)= 17 + 10+13 = 40
	u({A,C,D}, T21) =42.	
u(B,T31) = 6.	u({B,C}, T31) = 6+4 = 10.	u(A,D)=9.
u(C,T31) = 4.		u(B,D)=24.
	u({B,C},T41) =9+4=13.	u(B,E)=13.
u(B,T41) =9.	u({B,D},T41) =9+15=24.	u(C,D)=19.
u(C,T41) =4.	u({B,E},T41) =9+4=13.	u(C,E)=8
u(D,T41) =15.	u({C,D},T41) =4+15=19.	u(D,E)=19.
u(E,T41)=4.	u({C,E},T41) =4+4=8.	
	u({D,E},T41) =15+4=19.	u(A,B,C)=38.
		u(B,C,D) =32.
	u({B,C,D}, T41) =13 + 19 =32.	u(B,C,E) = 21.
	u({B,C,E}, T41) = 13+8=21.	u(B,D,E) = 43.
	u({B,D,E},T41) = 24 + 19 = 43.	
	u({B,C,D,E},T41) = 32 +21 = 53.	u(B,C,D,E) = 53.

Similarly, utility of transaction T51 can be calculated. Consider, Min_Util = 30, then the item sets BC, ABC, BCD, BCE, BDE, BCDE are high utility item sets.

Now, calculate loss profit for item A using equation (1).

For item A,

TID: 1

Loss Profit (A, T11) = profit (A, T11) + profit(B, T11).confidence (B→A) + profit(C, T11).confidence (C→A) = 5 + 6*2/4 + 7*3/5 ≈ $12.2

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Similarly, loss profit of item A in other transactions are Loss Profit (A, T21) ≈ 14.53, Loss Profit (A, 31) = 0, Loss Profit (A, T41) = 0, Loss Profit (A, T51) ≈ 19.03.

Thus, the total loss profit of item A using equation (2) is $45.763

Similarly, the loss profit (B), loss profit (C), loss profit (D) and loss profit (E), have been calculated as $69.72, $104, $59.06 and $15.99.

The essential objective of inventory management is to keep up stock position for various items. Utility mining helps in perceiving valuable items. Consequently inventory manager can concentrate on such valuable items and keep up required stock.

CONCLUSION

Data mining is a multi-disciplinary field, which derives sustenance from database innovation, artificial knowledge, machine learning, neural net, statistics, knowledge acquisition, data extraction, and visual technology, and so on. In this paper, utility mining algorithm is applied on transactional database to find frequent items. The loss profit of frequent items is then calculated. The loss profit of item is the total profit that the item may takes away when it is out of stock. A numerical example is presented to illustrate the utility of the new approach. The primary goal of inventory control is to keep up stock position for different items. Utility mining helps in recognizing beneficial items. Subsequently inventory manager can focus on such beneficial things and keep up required stock. The information got from such gainful happening items can be utilized by a grocery store to update the design of the store. This builds the benefit by putting interdependencies items close to each other and consequently fulfils clients through sparing time and customized the store design.

With the help of results obtained from proposed approach, retail stores like wal-mart, reliance fresh and big bazaar, can analyze their inventory data in a more realistic way. Their data can be mined using utility mining to predict patterns in whole database. These patterns can be further used to estimate loss profits of frequent items in whole database, which will help the retail stores to predict optimal order quantity more accurately. This approach results in higher profit to the stores.

FUTURE RESEARCH DIRECTIONS

A future study would be extended to propose the model by using combination of various data mining techniques in order to integrate the associated demand and the lost sales into the supply chain. Also, an inventory model will be proposed considering time series in scenario, where variables are correlated. Further, a methodology based on data mining techniques like utility mining along with genetic algorithm can be proposed in which minimum total supply chain cost can be accomplished. The obtained supply chain cost impact rules will possibly signify the future state of inventory for every supply chain member. The decision of level of holding and increasing or decreasing of inventory can be made using the supply chain cost impact rules. Thus, supply chain cost impact rules which are derived, help in optimizing the inventory and makes supply chain management more powerful.

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KEY TERMS AND DEFINITIONS

ABC Classification: It is a ranking system for identifying and grouping items in terms of how useful they are for achieving business goals.

Association Rule Mining: It is used for searching interesting relationships among items in a given data set.

Cross-Selling Effect: It describes the dependency of purchase of one item onto the purchase of another item.

Data Mining: It is the process of analyzing large amounts of data in order to discover patterns and other information.

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Inventory Control: It is the process of effectively managing stock items, parts or supplies.

Supply Chain Management: It is the process of providing the right product, at the right time, right place and at the right cost to the customer.

Utility Mining: It is a process of mining high utility item sets from a transaction database that have utility above a user-specified threshold.

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Chapter 13
Digitized Public Administration:
Using Gamification to Introduce Innovation

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ABSTRACT

Digitization affects all areas of modern societies. It influences education, industrial production, workplaces, and of course, leisure activities. Its impact can be witnessed in communication, workflow organization, and many other fields. International companies have been the forerunners of digitization efforts, but recently, public administration in Germany has caught up on the development. Being bound to laws and political guidance, public administrations are less flexible to adapt to new changes than privately held companies. Public administration is engaged in a constant fight for the best employees since payment is often lower for comparable work in private economy. Still, citizens expect a level of service and engagement they have learned to know from privately owned businesses. Public administration needs to motivate its employees just like companies have to. To do this, different strategies have been suggested. This chapter attempts to highlight common challenges and possible benefits of using gamification techniques in enhancing motivation in public administration.

INTRODUCTION

Gamification and nudging techniques are designed to engage, tie in, and connect staff with a desired goal. Gamification is the enrichment of everyday processes with motivational aids, be it bonus points, gratifications or competitions and even entertaining elements. Nudging is a form of soft paternalism and guiding of behavior while "preserving liberty" provided by "choice architects" (Thaler & Sunstein, 2008, p. 5) attempting to gently steer participants of a process into the direction that is desired by providing a variety of choices people can choose from. However, all choices would be chosen by and also beneficial to the one who acted as the architect of choices. In this article a gamified rollout of a new software in a department of the public administration will be illustrated. The basic premise is a common problem:

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staff in public administrations is often older of age and feels more saturated than comparable cohorts in privately owned companies. In such an environment, changing systems and introducing innovations is often met with skepticism.

For several years, the working world has no longer been dominated solely by issues such as employee participation or collective bargaining. Terms such as Industry 4.0, big data, automation and networking are changing the contents and fields of activity of almost all modern work areas - this applies to highly developed industrial distribution processes as well as to everyday activities in gastronomy. The "Internet of Things" (IoT) connects people with machines, virtual with real locations and all of these and more with network technologies in order to integrate them into digital processes via open interfaces – things become *social* functionalities (from "res agens" to "res socialis") (Atzori, Iera, & Morabito, 2014, p. 99).

Artificial intelligence (AI) and avatar systems like "social bots" (Meske, Amojo, 2018) also help to reduce thresholds in order to foster human interaction by acting "as a significant accelerator of social interaction across hierarchical levels and department structures" (Meske, Amojo, 2018, p. 5) and to raise acceptance and access amongst non-technical professions. The "digital workplace" not only increases efficiency but also allows more flexible forms of work through ubiquity and mobility.

Information and communication technologies (ICT) are expected to make the organization more efficient. Collaborative work relies on exchanges and flat hierarchies to help to receive an overview on requirements of different departments as early as possible and, moreover, to integrate customer needs, which are often revealed first to only a few departments with direct customer contact. Self-reliance of the staff is required in many modern administrations in order to confront demands from various sources - but this means that it must be supported by the management. Misunderstandings and bad planning, which can lead to considerable costs and delays, in particular in the introduction of ICT, can be prevented or minimized if the planning and implementation of such systems is collaborative and involves those who will later use or work with these systems because "they are familiar with the work and the context which the software system should support" and are deemed to benefit from it ("UPI – User Participation and Involvement") (Abelein & Paech, 2015, p. 29).

The "digitization" of public administration is a process that has been taking place for almost 40 years. Unlike in the past, however, there is no longer a strict separation between working and leisure time or tools at work and technology used at home. Life today is networked. Open systems such as social media and the constant availability of all information, the simultaneous use of information from a variety of sources as well as the constant accessibility have narrowed boundaries and wide spread technical know-how. While technical innovations of the past have often been tasks of specialized departments and later had to be mediated to the employees through training, companies of the Industry 4.0 era can often presume an already existing basic technical and procedural knowledge among the employees. In return, employees even in public administrations communicate with colleagues and supervisors and request feedback through many channels of communication around the clock. In addition, all activities are monitored and recorded in real time by an unprecedented growth of ubiquitous spatially aware technologies that facilitate not only 24/7 employee accessibility, but also continuous visibility of employees' tasks through workflow tracking technologies.

Productivity and efficiency are subject to complete control. Shirish et al. discuss the "spatial intrusion" into the personal sphere of employees through accessibility and control (Shirish, Chandra, & Srivastava, 2017, p. 5802).

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In public administration, digitization is essentially understood as shifting administrative tasks to a new digital level. It has also been regarded as the integration of traditional (paper based) processes into computer-aided processing structures aiming to optimize results and to accelerate proceedings. Another very important area is the publication of governmental regulations and official announcements online and also the possibility for citizens to submit applications over the net. This reduces waiting times at counters and enhances the overall productivity of public administration departments.

The introduction of the interactive Web 2.0 standard and, especially the smartphone technologies from 2007 onwards, familiarized vast parts of the population with apps and productivity enhancements. Nonetheless, although in private this expertise is embraced unhesitatingly and gladly, not everyone is willing to accept constant "visibility" and "accessibility"; a negative bias of employees may be "adversely influencing their productivity and innovativeness" (Shirish, Chandra, & Srivastava, 2017, p. 5802).

Social media and multiple apps on mobile devices have not only made people accustomed to the constant availability of data, products and services, but also have propagated freedom and independence. Relationships as well as consumer demands can be satisfied and evaluated at any time. Giving and receiving feedback has shaped individual decision-making. Enterprise social networks (ESN) offer appropriate exchange and cooperation opportunities at corporate level with the aim of promoting the exchange of knowledge and networking of employees. Functions such as discussion forums, individual profiles or microblogging are now common in customer-relationship-management (CRM), content-management-systems (CMS) or enterprise-resource-planning environments (ERP) (Günther, 2017, p. 865).

Consumerization, in turn, describes the intrusion of technologies formerly used for private and entertainment means into the business and professional sectors. Employee experiences with such technology is becoming an increasingly important reason for choosing appropriate ICT equipment in companies and administrations as employees are "increasingly striving for corporate use of the technologies familiar to them from the private sector" (Weiß & Leimeister, 2012, p. 364).

Since many privately used technologies aim at supporting and rewarding user activities to enhance motivation and to keep them engaged, gamified bonus and feedback systems seep into more areas than just leisure activities. Gamification and nudging gently guide and manipulate human behavior. They avoid direct and obvious control and would not work with commands and bans. They serve to increase efficiency and to harmonize work processes (Stieglitz, 2015, p. 817). International loyalty programs such as Payback and feedback systems such as Ebay or Foursquare have accustomed users to rely on feedback of others and provide ratings themselves. Gamification, in addition, is based on competition and entertainment. Such elements include rankings and high scores, awards, virtual goods such as access to specific areas of information and play. The basic needs of man are addressed here: the desire for fight and victory, success, recognition and reward.

Gamification as a trend is being met critically by advocates and adversaries. Advocates, such as Herger, stress the employees' opportunity of personally getting involved in the processes of change if these are perceived as exciting and inspiring instead of frightening and burdening, which makes it an ideal tool for Human Resources (HR). Thereby corporate objectives would be accomplished and become shared goals with the employees. A happy and motivated player / employee is "willing to go the extra mile, is more creative, shows more initiative, and this benefits everyone" (Herger, 2014a, pp. 8). Side effects of gamification in digitized environments are gains in motivation and work performance and a collection of data on personal performance which can be analyzed and compared with future results. Bogost is skeptical and emphasizes the aspect of the (unconscious) manipulation of the employees' behavior of

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which employees are often unaware. While they immerse in enjoyable work, they are ultimately being measured by their performance. Bogost, Dragona, Chaplin and others even speak of "exploitation", "sedation" ("pacification") or even "bullshit" (see: Piasecki, 2019, p. 46).

Also the fundamentals of public administration need to be considered: its services must be legally binding, focused on society, open to the public, low-threshold, informative, transparent and helping. Such a list seems to entail little space for "fun" or competition. According to Shirish et al. organizational learning is a process of "creating, retaining, and transferring knowledge within an organization". It takes place at four different levels: "individual, group, organizational, and inter organizational" and "organizational technologies have the potential to both enable and disable organizational learning, which is largely oriented towards positive organizational change for improved organizational outcomes" (Shirish, Chandra, & Srivastava, 2017, p. 5804). This article will explore possible effects of gamification on the creation and transfer of knowledge within a digitized administration while still keeping in mind that monitoring and an obvious manipulation of employees can "serve to demotivate employees and affect their performance adversely" (Shirish, Chandra, & Srivastava, 2017, p. 5805).

As society is changing, employees of administration are changing too and therewith administration and its internal and external services.

Developing and training employees is a crucial factor for the success of any company (Heilbrunn & Sammet, 2015, p. 867). Even though the services of public administration do not directly compete with commercial services on an open market, it still competes with private companies for good and motivated employees.

BACKGROUND

Administration 4.0

Public administrations, as well as large enterprises, find themselves in a constant conflict between the fulfillment of increasingly complex requirements expected by citizens and the need to be innovative, flexible and quick while being sustainable and cost effective. However, they are less flexible in planning and selecting options or in using innovations than companies. High costs, requirements of political decision-making structures and their dependence on public and media aggravate their situation. Since the introduction of ICT and stationary desktop PCs in the 1980s, the availability of cloud technologies since the early 2010s led to ever shorter innovation cycles. Public administration here followed the paths private economy had paved before.

Technical changes are affecting society and influence the range of services, working methods and fee structures public administration offers. Management needs to permanently act and think more flexibly, the pressure on staff and the fear of making wrong decisions, which in particular the political level wants to avoid, are increasing. Another point is equally important, albeit a bit out of the focus of public opinion: due to demographic change and the intercultural opening of public administration, its staff no longer works on the basis of the same habits, beliefs or attitudes. In addition to the ever accelerating "digital evolution" and the use of artificial intelligence and extensive planning applications, the HR departments become incubators of changes, too.

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This releases potential, but also poses dangers of misunderstandings and blockages. Innovation in public administration is, therefore, first and foremost a process of "social high-tech" that has to make use of a widening scope of technological innovations. More and more digital natives work in the public sector to whom ICT is common on a daily basis; sometimes they even use more modern technologies at home than they have at the workplace. For demographic reasons, more and more senior workers are leaving the public and private commercial sector in the coming years. Thus, new approaches are needed to resolve difficulties between central control, given structures, technical equipment and existing decision-making structures. Günther correctly points out that participation orientation is an important future task (Günther, 2017, p. 868). Management and specialized departments of public administration such as IT will need to involve the future users and profiteers of their work earlier and more actively and communicate their targets as not only binding, but desired.

Gamified work environments are not a contradiction to serious and professional work. Playful learning is important for children while sadly adults are considered to learn by serious means. From a certain age on, playing is considered frivolous while learning is seen as serious and must be regimented (Sheldon, 2012, p. 13). Gamification offers important motivational incentives for dealing with new procedures.

Another approach is the so-called Open Innovation paradigm which is per se open to external ideas and out-of-the-box thinking in order to achieve progress, as Chesbrough lined out on a number of companies. The integration of external sources of knowledge such as customers, suppliers and consultants into a company's innovation process played a key role there (Chesbrough, 2012, p. 22). This approach can also be applied to a company's or administration's internal affairs by involving all employees into the innovation process or by openly discussing ideas throughout the company.

Gamification at Work?

"Gamification" is the use of elements from games or game-like concepts in non-gaming contexts (Deterding, Dixon, Khaled, & Nacke, 2011, p. 9). "Gamification encompasses the idea of adding game elements, game thinking, and game mechanics to learning content." (Kapp, 2012, p. 17). Gamification strategies successfully address fundamental human motivations for action. These arise from intrinsic or extrinsic impulses, such as striving for recognition or the desire to belong to a group, to the very personal feeling of being able to do something special. In addition to such "self-actualization needs" as Maslow defined (Maslow, 2000, p. 261) or as Ryan and Deci described (2000b), next to the desire for self-determination other extrinsic motivations exist, which can be considered as medium-term rewarding factors.

Difficulties shall thus be transformed into challenges with a factor of entertainment (McGonigal, 2012, p. 156). Individual achievement is often visualized as bonus points, "awards" or "trophies" and is measured and turned into "rankings" or a leaderboard. One of the main ideas of gamification is to reduce or at least to modify the cognitive effort required for gaining knowledge or learning new skills so that the process is perceived as a source of encouragement or as a reward rather than as a burden. Its usage aims at making potentially boring activities more exhilarating as well as to make the individual progress of participants measurable. Another aim is to foster competition of learners among each other or against the learning environment, the learning system and its set of exercises (Hamari, Koivista, & Sarsa, 2014, p. 3030).

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Still, critics bring about the argument that this concept works especially because people would be conditioned to a behavior without their (at least full) knowledge of the backgrounds. Dragona summarizes critical approaches which describe this principle as "exploitation", "authoritarian"or "sedative" (Dragona, 2014, p. 229).

Gamification describes rather a process than just a set of tools. It combines various stimuli with partly automated feedback systems like progression bars to visually demonstrate the progress of an individual during a given task. Progress can thus be made comprehensible and perceptible (Marklund, 2013, p. 50). The comparison of individual achievements with others via rankings and leaderboards is important as well. Rankings encourage the examination of individual performance and fuel positive competition. Work process optimization refers to these: the solving of a problem provides a reward (e.g. via symbols & "awards"), the rewarded users feel encouraged to keep going while at the same time work and their learning progress is being evaluated. Entertaining elements can help to build up motivation and reduce moments of disappointment (Wolf, 2012, p. 565). Participants feel that they can choose tasks according to their own likings and not because the agenda "says so". Still the criticism of a "behavior modulation" must be taken seriously since making people to "like" their tasks forms the basic premise of the principle and is the main idea behind economic gamification (Paharia, 2013, p. 28). Its aim is the increase of work performance caused by an improvement of job satisfaction.

Behaviorist and cognitivist approaches of educational science explain why and how gamification works. Rewards and punishments play an important role in behavioristic models to explain an individual's actions. The behavior of a person is monitored. Controlled feedback reinforces or modulates the positive behavioral components. Intrinsic motivation is key to cognitivistic designs - Ryan & Deci's theory of self-determination names the three basic characteristics of intrinsic motivation: competence, autonomy and respect or social proximity and appreciation (Ryan & Deci, 2000a).

Some authors recommend the introduction of "stories" to embed individuals in a larger scope of narration – an example would be to address the need for ICT security against possible computer viruses as "Vermin Attack: Mission for Safety". While this seems to work for some environments and target groups (Zenker & Daubenfeld, 2014, p. 401), the inclusion of adults into a "storyline" just to raise involvement is rejected by others (Stieglitz, 2015, p. 818).

It must be kept in mind that gamification in itself is not a game, and *to entertain* is not an independent variable. Therefore, there is no 'mechanical toolset', no proven strategy for any circumstances. It is not *a single activity* that becomes a game, but an *enrichment of the daily routine* which contains *playful approaches* to make work more rewarding and to create and raise intrinsic motivation. Such intrinsic motivation may be triggered by external stimuli, but can increase through the satisfaction that comes from finishing a task out of a person's own abilities and motivation. In this way intrinsic motivation correlates with learning— any results are received positively and demand new challenges— while extrinsic motivation only evolves from rewards. Most importantly: extrinsic motivational stimuli can interfere with the learning success in the worst case by drawing the individual's awareness and aspiration solely to the stimulus (Sheldon, 2012, p. 75) and shifting the important learning effect out of view (see: Ryan & Deci, 2000b).

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GAMIFICATION

Optimizing Work Routines in Digitized Public Administration

Digitization processes impact all sectors of public administration and will do so even more in the future. They start with common filing and cooperation systems and extends to HR and corporate education matters (Diercks & Kupka, 2013, p. 5). Employees often struggle to leave outdated procedures behind as they still provide some familiarity. On the other hand, they sometimes are much more open to changes than management believes (Stieglitz, Potthoff, & Kißmer, 2017, p. 965). Fostering motivation by any means can only be positive, but implementing a gamified working environment is not a trivial task. It requires knowledge of and obeying the habits of different areas of the administration (IT, HR, management at least on lower and medium levels (Stieglitz, 2015, p. 818). Mandatory is a clear definition of the desired outcome and how any progress can be measured and visualized (Stieglitz, 2015, p. 818).

First, an analysis of the given situation is mandatory. If the introduction of new software is planned, as assumed in this example, existing system structures of software and hardware must be considered —not only in terms of their technical compatibility, but also their social connectivity and impact. Departments that have been annoyed for a long time react differently to innovations as if a system solution is purchased for the first time.

The purchasing of IT systems typically accounts for less than 25% of the total cost of ownership over the entire deployment period. Operation and support account for more than 75% of the much larger share of costs (Adams et al., 2012, as cited in: Auth, Meyer, & Porst, 2017, p. 941). The total cost-of-ownership approach takes this into account by considering operations and support in addition to acquisition costs, communications, end-user expenditures, and opportunity costs such as outages, training, and other productivity losses.

It is also to ask how and why gamification should be used and whether the planned software acquisition already has appropriate modules and interfaces or whether a parallel gamified infrastructure would have to be acquired and introduced. In both IBM Connections and SAP Jam ("Bunchball" feature) or Moodle corresponding functions can be activated. It may not be desirable for users to work with a new business solution and to additionally use a gamified application to help them learn the business solution. So, what we need is gamification "hip or hype" (Dale, 2014, p. 83), —how can potential resistance from users be minimized as a critical factor for failure (Auth, Meyer, & Porst, 2017, p. 942) and how can acceptance of technology be increased?

Extra work and frustration could possibly be the result and cause stress and overload due to (over)use of technology at the workplace ("technostress") (Köffer, 2015, p. 4). However, acceptance by employees is an important factor in the introduction of new technologies (Shahrasbi & Paré, 2015, p. 7). The more they perceive the benefits of an announced change themselves and the more they open themselves to change, the greater the final acceptance. Acceptance can be reduced or destroyed if employees make overall negative experiences. Shirish et al. mentions privacy restrictions, whether through continuous visibility and verifiability, or accessibility beyond the workplace (Shirish, Chandra, & Srivastava, 2017, p. 5803), which affect life in general.

Voit sees gamification as a method of change management and wants to see the individual employees in the role of change agents. However, this can only succeed if they experience positive "resonancing

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experiences" that they can combine with their tasks. Following Bauer (2013, pp. 14) Voit classifies resonance experiences into three categories (Voit, 2015, p. 906):

- Resonance with one-self: One experiences him- or herself as competent and can use and develop personal skills optimally
- Resonance with others: One experiences belonging to a group and receives respect and acknowledgment in the competition to pursue a goal
- Feedback with the world: One feels that he/she contributes to a better environment

Stieglitz et al. suggest three different degrees of intervention, based on the administrative needs and the sensitivities of the workers:

- Low: repeatedly highlighting and emphasizing the benefits of a new process, custom reminders on all available channels (email reminder, corporate chat rooms, poster posters)
- Medium: establish social "norms" through comparisons and by mediating that already a high percentage of colleagues use a certain function, defining preferences in the desired sense ("nudging" approach)
- High: recommendation of useful functions, direct reminder and imperative change requests (use of wrong functions or cumbersome usage procedure)

The more complex the intervention, the more expensive the implementation and the greater a possible feeling of supervision among employees (Stieglitz, Potthoff, & Kißmer, 2017, p. 975).

In public administration non-monetary motivators are just as necessary as in private companies, but for another reason. While the former is constantly battling for the best employees, the latter are trying to keep their best - because salaries are often fixed, gratuities are rather uncommon and even lazy employees are not easy to be resigned.

IT professionals employed in public administrations have in the past often been approached to accompany ongoing processes such as data security etc. *after* decisions have already been made on a higher level. Modern Unified Workspace Concepts try to reduce costs and create transparency by including current and future team members into the process of necessary decisions (IDC Central Europe, 2018, 6). In public administration it is often still them who are called on board when new software revisions are to be introduced in different areas. However, this means that only a part of their expertise is retrieved when it comes to future innovations and trends. As experts, as stated above, they are usually informed about current and future technologies. As they rarely have managerial functions in public administrations, they usually become aware of and get involved in fundamental changes when these have become an urgent matter already because these have first been discussed on the levels of political guidance and then by the heads of the administration. This way they often work behind the development and work on problems that have already come up a long time ago but were not declared as important enough as to demand immediate action. In such a situation they need to use what they have at hand to work out problems that have already developed and grown over months or years instead of having had the chance to work on a plan with concrete development steps and ultimately meet future demands with future technology or at least latest knowledge. An early consultation could have also allowed the available staff to be trained in good time.

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Procedures have been taken in German administrations for decades to further enforce digitization in order to make law collections, official announcements or basic information such as reports of council sessions publicly available. In many cases, however, it is especially older employees who continue to prefer paper filing and who tend to resist in executing digitization reforms consciously or unconsciously as well as more or less creatively (”Veränderungsresistenz“ – Resistance of Changes: Evers-Wölk, Oertel, Thio, Kahlisch, & Sonk, 2015, p. 70) although e-government-law defines standards to digitize daily routines for citizens like the registration of cars or archiving of documents etc. (IHK München und Oberbayern, 2017).

Gamification and Examples of Gamified Workflow Optimizations

Gamification builds on some basic premises:

1. the solution of a task is bound to a reward, the insofar remunerated users feel obliged to continue (Kapp, 2012, p. 17)
2. whilst with the help of information technology work and learning progress is being monitored and evaluated, the individual success is being visualized (i.e. through awards or leaderboards)
3. adding elements of entertainment is an effective and proven way of building up motivation and lessening failure (Wolf, 2012, p. 565)

Support and empowerment of employees through motivational control helps business goals to be fulfilled (Burke, 2014, p. 6) – likewise public administration could benefit from behavior-modulation (Herger, 2014b, p. 8).

Why is gamification interesting as a procedure that should be up for discussion? As was already stated, the target audience, regardless of age, is mostly socialized through media and events with close social relations— this means the expectation of entertainment and suspense is not only bound to entertainment products. Smartphone apps provide social connectivity, feedback and rewards all the time. Even if it is not explicitly requested, the absence of such social features for example at work will be recognized. That implies that tediousness is being rejected and entertainment is being preferred; especially since a smartphone can serve as a constant source for the desired fun-factor and so possibilities of distraction are in close reach most of the time. In general, not more than 30% of learning is done in the formal contexts of traditional education nowadays (Kahnwald, 2008, p. 282). Learning today means learning-through-media. Media-induced content, entertaining methods and motivational help and rational reasons to learn blend together. *Why* one learns leads to the very important field of *motivation*. Davidson et al. speak of “instrumental” and “integrative” motivation: they for example consider the wish to learn a language just to pass an exam to be a type of “instrumental” motivation while on the other hand the desire to interact, socialize or to become friends with members of a foreign community is an example of the “integrative” type of motivation (Davidson, Gulka, Valle, & Castonguay, 2014, p. 236). Such forms of “intrinsic” or “extrinsic” motivation to perform tasks and ways to support and foster motivation are the main concerns of any gamification procedure.

Even working environments that in the past were overshadowed or even dominated by an atmosphere of pressure and anxiety (Hepp, Höhn, & Vogelsang, 2010, pp. 9) are today influenced by the “eventisation of life”. Games, therefore, take on an important role: they represent learning environments, “in which

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learners as players can lose themselves for extended periods of time, and begin to think from the 'inside out' gaining situated understanding" (Coakley, Garvey, O Suilleabhain, & Pivec, 2015, p. 9).

Game mechanics are well suited to make boring standardized processes and repetitive work more interesting and to keep up the attention. At the same time they alter and manipulate people's behavior and minds: rewarding systems can motivate but also bind emotionally. Through the means of gamification workplaces still do not become playgrounds, but such environments can help to reduce stress and build up social capital and loyalty (Oprescu, Jones, & Katsikis, 2014) by varying the speed and content of tasks required for work.

The use of gamification is not just about positive resonance experiences. The target group must still be aware of the serious background of a progress. Voit even points out that it may probably be better to avoid terms that sound too much like "games" because this may lead to the process not being taken seriously by the employees or— even worse – by making the employees themselves feeling not to be taken seriously (Voit, 2015, p. 909). Kumar and Herger warn of the "chocolate covered broccoli approach" (Kumar & Herger, 2013, p. 12). By that they treat ironically the basic assumption that gamification always works just by adding game mechanics to their application and calling them "gamified". There is more to it than just applying a layer of fun and enjoyment.

Before a selection of game elements and their final implementation can happen, appropriate game mechanisms must be adapted to the resonance needs of the target group and the client's needs and should appear as "far from being opposed to work, they actually complement it" (Savignac, 2016, p. 38).

For Voit, this results in three dependencies (Voit, 2015, p. 913):

- Target group dependency: motivational situation of the participants
- Problem dependency: concrete approaches to concrete challenges
- Cultural dependencies: adapt intended actions to the culture of the department

These requirements stand in opposition to a simple plug-and-play approach (Voit, 2015, p. 913) .) — even "chocolate" would not help here. As a result, the participation of all different user groups in a company or administration must play a major role in the analysis of the environment that is about to be changed. At the same time, existing experiences of employees in the use of IT in their private environment is of great importance. They bring their private experience into the company and this shapes their expectation on ICT use there. Due to this complexity, potential users and their needs and abilities should be involved as early as possible in the designated tasks (Günther, 2017, p. 871).

Oprescu, Jones and Katsikis compiled a list of ten guiding principles that facilitate the use of gamification in everyday workplace processes (Oprescu, Jones, & Katsikis, 2014):

1. I Orientation: because the employee is placed at the center of the experience his self-efficacy and engagement is strengthened
2. Persuasive elements: these help to increase satisfaction by the modulation of behavior
3. Learning orientation: focus lies on knowledge acquisition and skill development
4. Achievement based rewards: employees can expect a certain return on their workforce investment
5. Y-Generation adaptable: new generations have grown up with gaming technologies and therefore have developed expectations on how to be rewarded for progress they have made (e.g. in games)
6. Amusement factors: inclusion of humor, play and fun

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7. Transformative: a balanced and attractive combination of competition and collaboration enhances overall productivity
8. Wellbeing oriented: personal wellbeing leads to organizational wellbeing
9. Research generating: the encouraging of collaborative research efforts require precise monitoring
10. Knowledge-based: knowledge as outcome or provided feedback helps to develop personal and organizational capabilities and resources

These basic premises shall subsequently be taken into account in an example for a gamified software rollout within a department of public administration. It aims at adding the momentum of excitement to potentially boring or demanding activities, making progress measurable and intents to create a competitive environment so that team-members could challenge each other or even compete against the learning environment–system itself. Problems are supposed to be converted into challenges with a fun factor (McGonigal, 2012, p. 156).

As already stated, within gamified environments individual achievements are often symbolized by graphical awards or trophies, and become visualized in rankings (de-Marcos, Dominguez, Saenz-de-Navarrete, & Pagés, 2014, pp. 84). The central idea of gamification is to decrease or at least vary the "cognitive load" (Wild, 2015, pp. 8) that is necessary to acquire knowledge and skills, so that information accumulation and processing is not viewed as pressure but as a possible source of future reward and motivation.

The direct measurement of success, competition and the recognition of one's effectiveness plays a big role especially in areas of economic gamification. Zagel & Bodendorf (2014, pp. 15) describe the efforts of the METRO corporation to change the way goods in their warehouses were registered and stock counted via radio. Employees were to slowly walk down the market corridors and scan products. This task was previously considered boring by employees because of the standardized process and its repetitive nature; errors kept occurring, which can be at least partly explained by a lack of interest and motivation of employees or disturbances by regular customers. This prolonged the task drastically. Gamification was used here to help making this task more exciting and to add gaming elements like contests for a low rate of mistakes or a race against colleagues or against the time.

Bunchball.com has installed a solution for American T-Mobile that shows the rate and quality of contributions of employees in an inquiry-system based on feedback received. People were able to perform a self-check and compare themselves with others and also check to see how much help they were to customers and even if colleagues shared their own knowledge with others. The system generated even more data about customer needs and strengths of employees as assumed (Bunchball, 2014, p. 5). This project will serve as a model for the example that will be laid out below.

Buckmann reports on changed personnel selection procedures at the public transport of the city of Zurich/ Switzerland. There, cartoons were used very successfully for recruitment. This campaign was a response to a change in information and communication habits of modern clients who are present in social networks, research their information on the Internet, and are otherwise constantly engaged in multichannel communication with like-minded individuals about their interests. Buckmann states that such cartoons have been unusual in HR marketing so far and therefore attracted attention due to its novelty factor (Buckmann, 2013). He uses the term "recruitainment".

However, one has to speak of a marketing gag rather than a successful gamification of the recruiting process, as illustrated for example by Ullah describing a gamified informational project of Deutsche Bahn (Ullah, 2013). Like Buckmann, Ullah emphasizes the need to associate business information with

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"storytelling", to personalize and emotionalize the information provided and to bring it closer to the customer (Ullah, 2013, p. 98). In doing so, he did not conceive new services for his employer, Deutsche Bahn, but made use of existing ones not unlike the service Foursquare provides, a rather privately used entertainment network. Using the Foursuware technology he created links and "events" inside the app to the locations of Deutsche Bahn and, for example, made local job offers visible. As a result, users spent their free time using Foursquare's services, but they also became aware of DB's "recruitment" items.

In addition, he has inserted an "expedition" through Berlin's Central Station, which illustrates the different jobs and businesses there (Ullah, 2013, p. 101). More QR code hunts were created around the Museum of Deutsche Bahn (Ullah, 2013, p. 102). In conclusion, he describes recrutainment as the "high art of event design" (Ullah, 2013, p. 103). Such events can also be inserted in public administration workflow optimizations. On the contrary, as already stated, any "story-mode", "expedition" or "journey" etc. may appeal to some and not appeal to others. A quick glance at Bartle´s "player types" may help to explain this. According to him, individuals belong to at least one of the following types of players (see: Bartle, 2003, pp. 130):

1. Killers: Defined by a focus on winning, rank, and direct peer-to-peer competition and engaged by Leaderboards and Ranks. Killers have fun acting on other players (Bartle, 2003, p. 132)
2. Socializers: Defined by a focus on socializing and a drive to develop a network of friends and contacts. Engaged by Newsfeeds, Friends Lists, Chats. Socializers have fun interacting with other players (Bartle, 2003, p. 132)
3. Achievers: Defined by a focus on attaining status and achieving preset goals quickly and / or completely. Engaged by Achievements. Achievers have fun acting on the virtual world (Bartle, 2003, p. 132)
4. Explorers: Defined by a focus on exploring and a drive to discover the unknown. Engaged by obfuscated achievements. Explorers have fun interacting with the virtual world (Bartle, 2003, p. 132)

If gamification is to be used for work, employees need to be considered as types of players. And players want to win. vijoNext to the economical advantages of gamification, Chou observes the aspects from a standpoint of human-sciences and social-psychology: from the perspective of an individual a solved task / problem grants a person a higher status in a group (Chou, 2015, pp. 215). If tasks are achieved that were not expected or requested, even more personal gain and respect from others can be expected and witnessed, if for example team-members become skilled experts and teachers themselves. They learn that any individual effort is being recognized by the management and will be rewarded. This slowly builds up much stronger teams and piles up social capital because fun factors and its resulting benefits in motivation can be used to support an individual's position in a group.

Gamification in Practice: An Example

The introduction of new procedures or, in this case, software versions or entirely new applications in the public administration is generally considered to be rather unpopular. Especially if these are implemented into the running operation, causing the need of doing tasks twice in some cases: using the regular "case file" on paper as well as in digital form. Lack of experience or lack of training as well as early software bugs can lead to loss of data and cause frustration. These are always good reasons for staff to leave their

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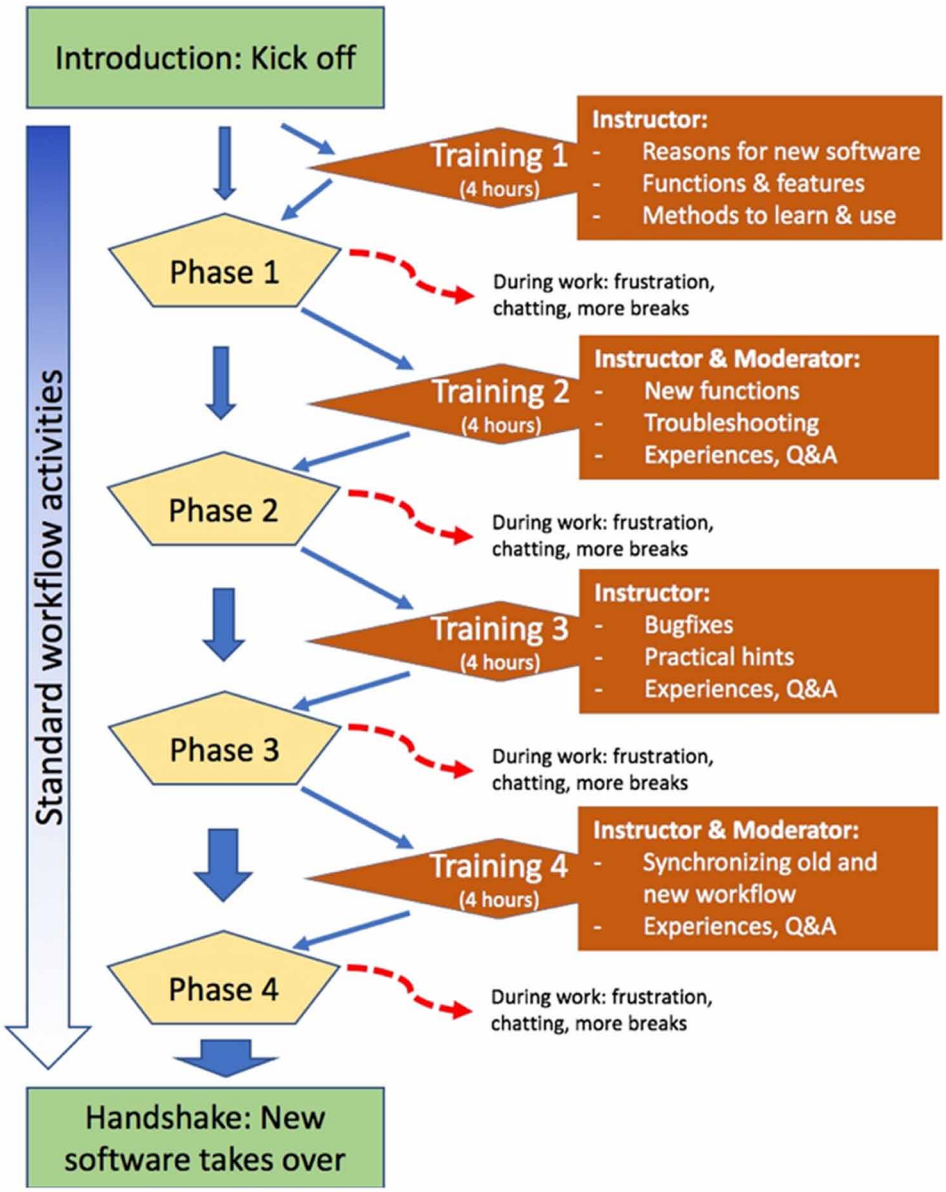
desk in order to ask others for help or to take the heat off otherwise. This can take a rather long time, depending on what other (maybe non work-related) subjects there are to be discussed with the colleagues.

Figure 1 shows the usual method of implementing new tasks or working elements into a running operation:

While the standard workflow continues (left), a new application needs to be introduced first.

After the initial Kick Off situation several levels of training / courses will be provided, each taking some time, keeping staff away from work. Also, next to a professional Facilitator or Instructor, depend-

Figure 1. Standard procedure of the implementation of a new business process



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ing on the situation and team quality, a moderator may be needed (or the head of the dept.) to explain / demonstrate the importance.

Each training phase is followed by practical phases in which new software features will be implemented or skills being learned and practiced.

Unknown working environments and inexperience often cause frustration. They lead to an increased amount of absence off work to ask colleagues, to discuss hints and workarounds or to avoid tampering with any change that is unwanted anyways.

Result: The whole process of software implementation remains alien to the staff. It was a corporate decision which is not being welcomed and shared.

The process is time-consuming and costly.

If a gamified software rollout like the one portrayed here is applied in public administration, this could mean that:

- A new software version is delivered with a chat function and help forum and probably an interactive social (chat) bot
- Staff is displayed with name and pictograph if they are currently working in the software (as it is seen in shared cloud office applications) – individuals can choose their own picture, personal or even funny images are allowed
- Software bugs can be reported and discussed immediately from within the software
- A "private" section is available for the discussion of "soft matters" (meetings, trades and sales to make staff come back to the tool not only for work but out of private reasons)
- Any colleagues who are displayed as being "active" or currently online can be asked for advice. This, according to Shirish et al., helps to enable faster cross-learning while on the other hand the feeling of being visible and controlled may have opposite effects (Shirish, Chandra, & Srivastava, 2017, p. 5806)
- Posted questions and assistance in the forums are rated using a scoring system
    - equests receive 1 point: the willingness to report observations regarding the program is encouraged
    - assistance receives 2 points: the willingness to help others is encouraged
    - confirmed help ("problem solved" - confirmation from staff) receives 3 points
- The posting behavior of all staff members is ranked and displayed on a leaderboard using the scores provided through the system; in order to offer an additional incentive, the manager or head of department can offer additional group rewards for the completion of the process - this way everybody benefits and no feelings of envy emerge. At the same time underperformers and isolationists within a team become visible without being addressed directly. They can change their behavior through self-reflection

Figure 2 shows a slightly gamified working environment and social testbed for a new application. Here we have the explanation of Figure 2:

Again the whole process is started by a Kick Off event (meeting, presentation etc.).

Also, strategic information is provided throughout a first training phase, run by the Facilitator or Instructor and also the Moderator or Manager to underline the necessity of the process.

The new application features not only the necessary elements for work, but also some basic social networking features, like:

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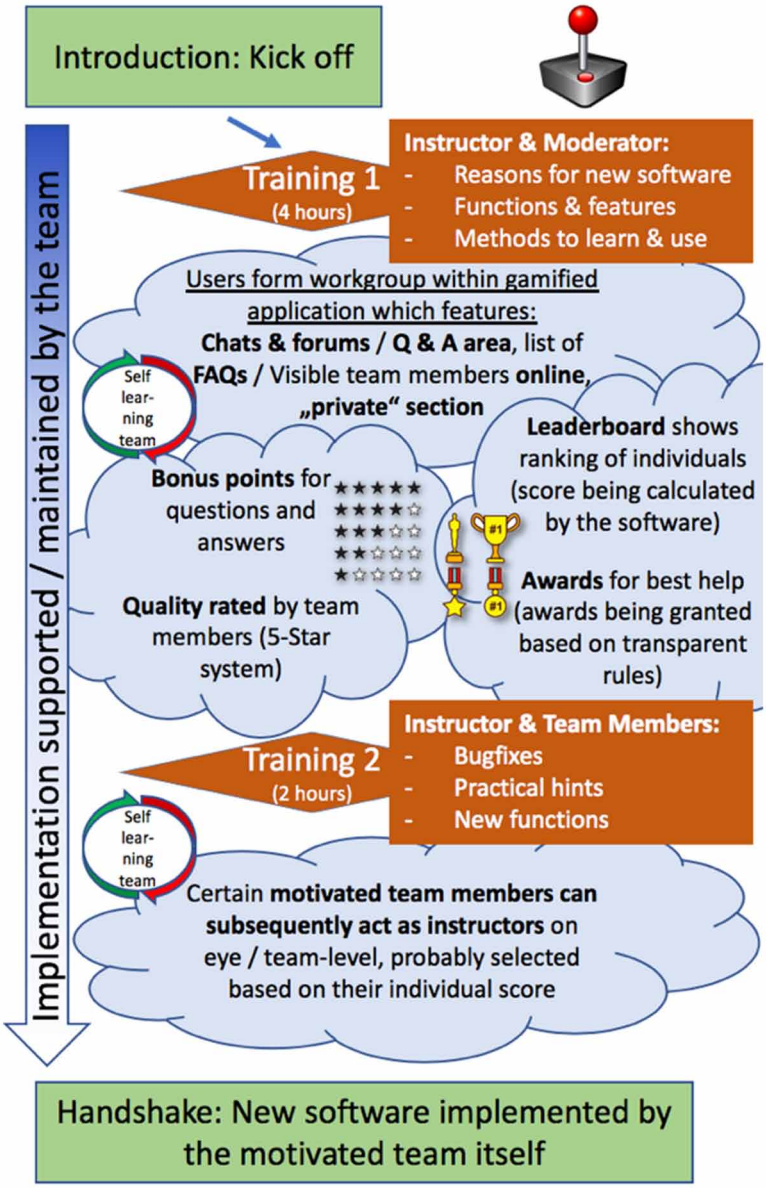
Figure 2. Gamified implementation of a new business process



- Chats and forums
- Question & Answer areas
- FAQs which can be enhanced and commented by the staff (like a Wiki)
- Private section

To highlight those of a team who are active and show solidarity with others, any question receives 1 Point, any assistance 2 points. Problems solved 3 points. Others rate responses by giving “stars”.

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The software maintains a leaderboard with any individual's score to foster both transparency as well as a challenge. Highscorers receive a trophy.

What is most important is: the whole process is transparent, has a defined beginning and a defined ending. Everyone is involved, everyone benefits. At the same time the need for "chit-chat" off the desk is being decreased, the "private" section allows quick mental breaks and individual ambition is spurred by a scoring system. The integration of a private (albeit publicly visible) area also shows that the management knows about and accepts the necessity of private matters at the work space – which again gives staff more responsibility to get the work done. For many such a process of "software implementation" could appear less difficult or even frightening, as every employee can contribute according to their own interest and speed and progress is experienced collectively.

SOLUTIONS AND RECOMMENDATIONS

The changed administrative and technical conditions of modern workplaces mean that employees and their competences, their knowledge and skills need to be constantly further developed.

Employees must be able to solve their tasks and master their working equipment. In addition, they must be capable of innovation and development. This connects them with their leaders. A pure functionality of an employee in the workplace is often no longer sufficient or desirable. Decisions have to be made, employees need to understand themselves as collaborative elements and parts of system of an administration and act in a networked way. The same applies to managers in areas of low physical presence (due to flexible working time or home office work) and a great agility with simultaneous necessity of change.

In addition, there are usually various interdependencies between the persons involved in an agile organizational structure with decentralized managerial structures. By emphasizing self-organization, employees may delegate their own responsibility and tasks to others. This means that the communication and cooperation with other employees in such an environment can always include responsibility and influence on the performance of others (Günther, 2017, p. 866).

The introduction of gamification also requires the involvement not only of the management but also other actors such as the works council, department heads, representatives of the communications department and the IT department and those who will be affected by the change. In consultation with the respective representatives or by forming a specialized working group, the objectives, the design, the introduction and the evaluation of the gamification process must be developed and planned (Stieglitz, 2015, p. 819).

Another critical point that can be raised by the works council or by employees— if it has not already been considered before the launch— is privacy rights and data security. A scoreboard for example or "likes" for employee postings could inadvertently be interpreted as the basis for evaluating employee performance (Stieglitz, 2015, p. 824) and become (in the eyes of the employees) subject of interrogations by the HR dept. On the other hand, if a scoring system is anonymous it loses its appeal. Nicknames or aliases could provide a work-around.

Surveillance technologies are said not only to expose employees visually but also to unveil their online spaces, implying invasion into the material traces of their intellectual, emotional and relational movements [13, 15]. (…) Personal space is a resource for play, critical independence, tinkering and behavioral

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variations. Lack of control over personal space can weaken the capacity for democratic self-governance (as opposed to a modulated form of governance) and citizenship, which can affect the meaningful formation of agendas for human flourishing. (Shirish, Chandra, & Srivastava, 2017, p. 5803)

Referring to Cohen's (2008) spatial privacy concepts visibility and accessibility can have detrimental effects and individuals might be keen to seek (or regain) control over this intrusion just as Cohen characterized "the spatial dimension of the privacy interest as an interest in avoiding or selectively controlling the conditions of exposure" (Cohen, 2008, p. 194).

Gamification may raise acceptance for such intrusions into the personal space at work, which later may lead to an ever higher degree of frustration.

If introduced and progressed well gamification creates motivation through exhilarating and interactive additions to standard procedures. Resolved tasks ("work") appear to participants as a result of their own action and individual decisions. It aids the needs of members of "eventicized" societies and is suitable to lower entrance barriers. Even though the term suggests similarities, it has actually very little to do with games or even video games – it utilizes effects of video games on the learning ability of subjects, such as those measured and highlighted by Bejjanki and others (Bejjanki, Zhang, Li, Pouget, Green, Lu, & Bavelier, 2014, pp. 16961): rewards, entertainment, competition, the creation of curiosity make boring tasks interesting and bring up new problem solving strategies as well as enhance individual energies and interests.

On the contrary: without proper reflection gamified workflows may lead to a rather operant conditioned expectation of provided stimuli and rewards rather than to a development of transferable and adaptable individual abilities. Or as de-Marcos et al. point out, "dictums like … "gamify it and they will be motivated" seem to be equally flawed simply because they are ignoring the necessity of an underlying sound pedagogy" (de-Marcos, Dominguez, Saenz-de-Navarrete, & Pagés, 2014, p. 91). Gamification is a set of methods that need to be carefully introduced and used according to the audience and the content being taught.

Another point of criticism is the aforementioned effect of the overlapping of intrinsic motivation through extrinsic impulses. Not only Ryan and Deci have been reporting and affirming this. Earlier, Bem surveyed functional relations between external stimuli like compensations and attitude change (Bem, 1967, p. 191). According to Lepper, Greene, & Nisbett (1973) external stimuli like rewards do only have a short lasting effect on motivation while intrinsic long-term motivation gets drastically reduced due to the reward becoming "expected", named as the "overjustification effect" (Lepper, Greene, & Nisbett, 1973, p. 135). They came to the conclusion that rewards initially contribute to a higher rate of motivation, but may later lead to the opposite effect resp. condition the individual behavior because, "(...) rewarding subjects with money and "closely related tangible rewards" for engaging in an intrinsically interesting task would decrease their subsequent interest in that task in the absence of such external rewards" (Lepper, Greene, & Nisbett, 1973, p. 130). A bonus that is accounted for and has no effect of surprise anymore therefor leads to a decrease in motivation, just like the absence of any gratification at all. "The successful implementation of powerful reinforcement systems demands considerable sensitivity as well as ingenuity on the part of the practitioner" (Lepper, Greene, & Nisbett, 1973, p. 136).

This results in the important fact that a vital step in the preparation of the implementation of a gamified process is to evaluate which gamification approaches could work in a given environment and how they would have to be adapted technically and in terms of the needs of a company or public administration.

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Gamification elements should be coupled to appropriate processes. If the entertainment factor fails to come into effect, the whole process can become more boring than before, if it is too much fun, "it risks obscuring the learning objectives" (Sheldon, 2012, p. 16).

Apart from bonuses and artificial motivators, employees need to feel distinct responsibility for their role in any processes of change. Gamification is not team entertainment but legitimate motivational and thus structural help. Especially active feedback systems can help to let learning results become internalized and enhanced. Feedback from *team members as tutors* might be even more valuable than the feedback of any supervisor, as they are received on a level of equality and thus are freely accepted and taken more seriously.

CONCLUSION

Continuous processes are the evaluation and reengineering of the gamification concept used. Whether gamification elements have either become operational throughout an organization or only in certain areas, it is essential to obtain information on whether and how much the concept is being adopted and what its effects are. This can be done by collecting the usage data as well as performing (supplementary) interviews or broader questionnaire-based surveys to gain a deeper understanding of the effects of the gamification elements. This, however, should be done in a transparent manner since it has been shown that appropriate approaches sometimes cause a positive response among employees only for a short time, but are later perceived as meaningless or disturbing (Stieglitz, 2015, p. 820).

A quick change of different gamification elements also seems problematic, because the employees would have to deal with new concepts again and again. In addition, if certain gamification concepts have been introduced already, reducing or removing them may result in lock-in effects. Employees would then view the absence of gamification elements as a loss of their successes achieved so far under the system. This may make it even more difficult for management to stop gamification strategies (Stieglitz, 2015, p. 823).

In order to be able to identify positive results, concrete goals must have already been defined in advance like shorter response times or an increase in the quality of the work. Likewise, a more complete documentation of processes, the completion of profile information (e.g. of customer information in a CRM system) or an intensification of the communication between employees could be goals whose achievement can be made measurable (Stieglitz, 2015, p. 821).

Those who are ahead of technical developments by the nature of their profession, like IT-specialists, should be permanently deployed as scouts rather than as retrospective troubleshooters if all else failed – just as a well working group or department is a constant process that must be actively maintained. Those scouts have to be understood as permanent tutors, while in common practice they are often regarded as "freaks", "nerds", "geeks" or "techies" (not to mention that they often like and even emphasize this image).

Supervisors should be part of a gamified process until the end, both as a factor of control and also as a praising or rewarding element. Supervisors are usually visible, they need to start and finish a process of change. Otherwise they run the risk of the process becoming random.

Steps to take before the start of a gamification process include:

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1. Analysis of the current situation at the workspace
2. Analysis of the needs and preferences of the company or administration
3. Analysis of the desired innovation (and reasons)

At the time the gamification process gets to be initiated a focus must lie on:

1. Integration of the departments
2. Identification and approach of players (IT, management) and multipliers (works council, team leader)
3. An open discussion of the project

Followed by:

1. Selection of suitable gamification elements
2. Customization, identification and selection of appropriate departments and processes
3. Provision of information and FAQs
4. Roll out of innovation and internal communication campaign

Finally the rollout of a gamified innovation can be started.

In the end the successfully implemented gamified process needs to be evaluated and reengineered by the use of:

1. Survey and analysis of quantitative key figures and qualitative usage data (experience)
2. Comparison of ex-post with ex-ante status
3. Adaptation and possibly modification / extension of gamification elements

Gamified progresses within public administration can be conceived by employees as a benefit, if

1. The targets are defined clearly
2. Each step is visualized (e.g. by “levels” that are reached)
3. The need for a change and the progress is obvious to every single employee
4. Progress is communicated as positive for everybody and is visualized coherently
5. The target is not set too high
6. Experienced team-members are available and approachable for help

The challenge for public administrations here is that - unlike in the private sector - data protection and governance and compliance are essential and must be taken into account in a more user-oriented design (Günther, 2017, p. 866). While companies can act more flexible, administrations must strictly work according to laws. A digitized workplace is nothing but a socio-technical ecosystem – optimal solutions need to take social and technical aspects into account (Ulich, 2011, pp. 198) and put the user at the center of the design of the digital workplace.

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If done well, gamification can serve as an entertaining "lubricant" to ignite and fuel much needed social process as foundation of the administration's digitization and professionalization.

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KEY TERMS AND DEFINITIONS

Digital Natives: Those born after 1970 who learned that computers and technical devices are a common part of their daily life and aid many tasks.

Gamification: The addition of fun-elements to normally *serious* and non-fun processes like learning or working to raise motivation and alter attitudes and behavior.

HR: Human resources. Department that is responsible for employees.

ICT: Information and communication technologies – computers, mobile devices, web-based services.

Leaderboard: A ranking list that can show the position of a person or its advancement compared to others.

Nudging: Providing gentle "nudges" is an alternative way to modulate the behavior of individuals and helps to avoid bans or official regulations.

Public Administration: Being a welfare state, many areas of public life in Germany are organized or governed by public services. Public administration has little or no commercial interests and strives not to compete with privately run companies.

Story/Storyline (a.k.a. Missions/Quests): Storylines are vital parts of any video-game-narrative. They structure the progress of players and provide a wider scope of the individual task. In learning environments, they help to raise motivation. To go on a "quest" appears more interesting then to solve a task.

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Web 2.0: Standard of internet functionalities. Offers channels of communication and information and allows users to interact and participate in a higher degree than allowed by the former Web 1.0-standard with its focus on the reception of information.

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Chapter 14
Industry 4.0 and Its Effects on the Insurance Sector

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ABSTRACT

Industry 4.0 defines the fourth industrial revolution, a new level in the organization and management of products and production systems. This cycle consists of services that include the entire chain, including individualized customer requests, product development, production order, distribution, and recycling to the end user. One of the most important preconditions for the realization of the Industry 4.0 revolution is that companies have completed their digital transformations. New technologies and digitalization have brought a new understanding of insurance. Insurance companies are focused on four areas such as big data, artificial intelligence, internet of objects, and blockchain in the changing world. With the changing habits of consumers in their daily lives, new generation insurance needs emerged. The introduction of a new era shaped by the insurance industry with new products, services, competitors, and customer expectations will have various effects. This chapter describes how Industry 4.0 transforms the insurance sector.

INTRODUCTION

The main starting point for Industry 4.0 and Industrial Internet cases is the function of connectivity. The connectivity function here refers to software and culture differences that exist in different units of businesses (Bauernhansl, 2014). This reveals that the process of change that brings Industry 4.0 to the agenda should be more closely linked to the stakeholders of the enterprises' own ecosystems and value chain rings (Ersoy, 2019). Therefore, each enterprise (its suppliers, customers, support organizations) is increasingly convinced by the idea of more efficient and efficient cooperation with its stakeholders and aims to improve customer needs through horizontal cooperation initiatives (Goasduff, 2015).

Industry 4.0 provides opportunities for easier, better quality and cost-effective fulfillment of already built businesses. In addition, it has the potential to contribute to the creation of business models, ways of doing business, new processes and activities that do not exist yet.

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The concept of Industry 4.0 was first introduced in 2011 as a proposal by a group of representatives from different fields (eg, businesses, politicians and academia) to increase competitiveness in the German manufacturing industry (Gilhuber, 2017). The main aim is to increase the dominance of the country in machinery and automotive manufacturing in this new industrialization. In this context, the German federal government adopted this idea in the 2020 High Technology Strategy (Alçin, 2016).

Industry 4.0; it can be defined as the sum of the developments in information and communication fields and the integration of internet technologies with the intensification and transformation of production processes (Avşar, 2016). In other words, Industry 4.0 will transform the entire value chain, revealing new ways and opportunities to develop innovative products and services (Baghare et al., 2015). The following figure illustrates the components of some Industry 4.0. Each component contains different sub-components in itself and analyzes innovative (innovative) products and services development techniques to better satisfy the needs of the enterprise / customer.

Industry 4.0 is expected to affect all sectors. It is expected that the insurance sector will experience change and transformation with Industry 4.0. It is inevitable that the insurance sector will be affected in many areas such as access to insurance customers, determination of insurance prices, sales of insurance policies and damage transactions (Banger, 2017). With Industry 4.0, dynamic and pay-per-use insurance products will become widespread and these insurance products will offer new opportunities based on consumer behavior (Shafig et al., 2015). The traditional products, which are renewed after 1 year of purchase, will change according to the behavioral models of individuals. Moreover, it is expected that micro products such as phone battery insurance, aircraft delay insurance, home appliance insurance will be formed and spread (Sanders et al., 2016). In this way, the special needs of the customers can be met instantly with comparative options from individualized product baskets of insurance companies.

The change and transformation that Industry 4.0 will make in the insurance sector will make itself felt in insurance branches (Blum, 2016). When self-driving autonomous vehicles go on the road, conversion in auto insurance will be inevitable. Driving habits of the drivers (sudden acceleration / braking), the ways in which they are frequently used, and the ways in which these roads are used in transportation according to the accidents reported on these roads can be known independently of the driver (Soh and Unkefer, 2014). In the event of an accident; where the accident occurred, the time of the accident, the weather at the time of the accident (rain, snow, excessive dry ground), the accident was noticed that the number of seconds before the brake was pressed, before braking is watched with how many km speed, the speed of the collision took place with how many km we have There will be a very rich data set, together with a few pictures to be taken from the scene, all these data sets and accident records can be created very quickly, and insurance companies can also distribute damage rates more objectively to drivers.

This section discusses the transformations and changes that Industry 4.0 will create in the insurance sector. Industrial revolution and the historical development of Industry 4.0, the interaction of the insurance sector with Industry 4.0, machine learning, the internet of objects, artificial intelligence and its impact on the insurance sector are detailed.

INDUSTRIAL REVOLUTIONS AND INDUSTRIAL 4.0

Industry 4.0 or 4th Industrial Revolution is a collective term that involves many modern automation systems, data exchanges and production technologies. This revolution is a set of values consisting of the Internet of objects, services of the Internet and cyber-physical systems (Long et al., 2016). At the

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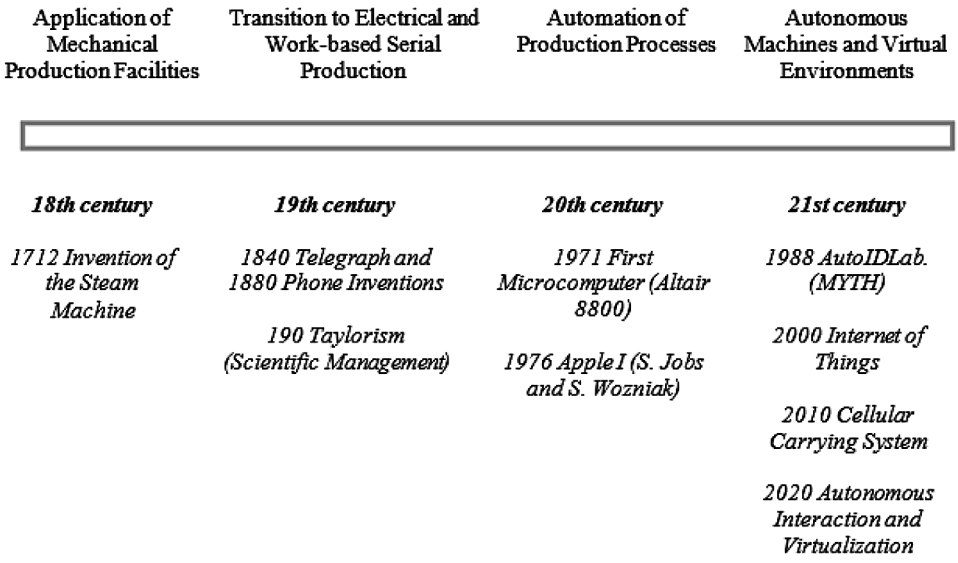
Figure 1. Industry from 1.0 to 4.0



same time, this structure plays an important role in the formation of an intelligent factory system. This revolution will allow more efficient business models to be created in the production environment, as each data will be collected and analyzed in a good way. Industry 4.0; it is an approach that aims to maximize computerization in the manufacturing industry and therefore to equip the production with high technology. Here are three main objectives (Wang et al., 2016):

- Minimizing human labor in production and eliminating the errors in production in this way.
- Providing the highest level of flexibility in production and the possibility of making products specific to consumers.
- It is the acceleration of production.

The first industrial revolution (1.0) emerged with mechanical production systems using water and steam power. The second industrial revolution (2.0) introduced mass production with the help of electrical power. In the third industrial revolution (3.0), production was further automated with the digital revolution, the use of electronics and the development of IT (Information Technology) (Banger, 2017). The historical process of industrial revolutions is shown in Figure 1 (Kesayak, 2019).

Finding of mechanical machines that provide more efficient use of water and steam power. Henry Ford's production line design and production of electricity in mass production, production line development (Thoben et al., 2016). In the 1970s, the production of mechanical and electronic technologies was replaced by the introduction of programmable machines which led to the replacement of digital technology (Gorecky et al., 2014). Today is in this industrial revolution. Industry 4.0 is a collective whole of the concepts of technologies and value chain organizations. It is based on the concept of cyber-physical systems, objects, internet and the internet of services. This structure makes a great contribution to the formation of intelligent factories vision. Industry 4.0 generally consists of the following 3 structures.

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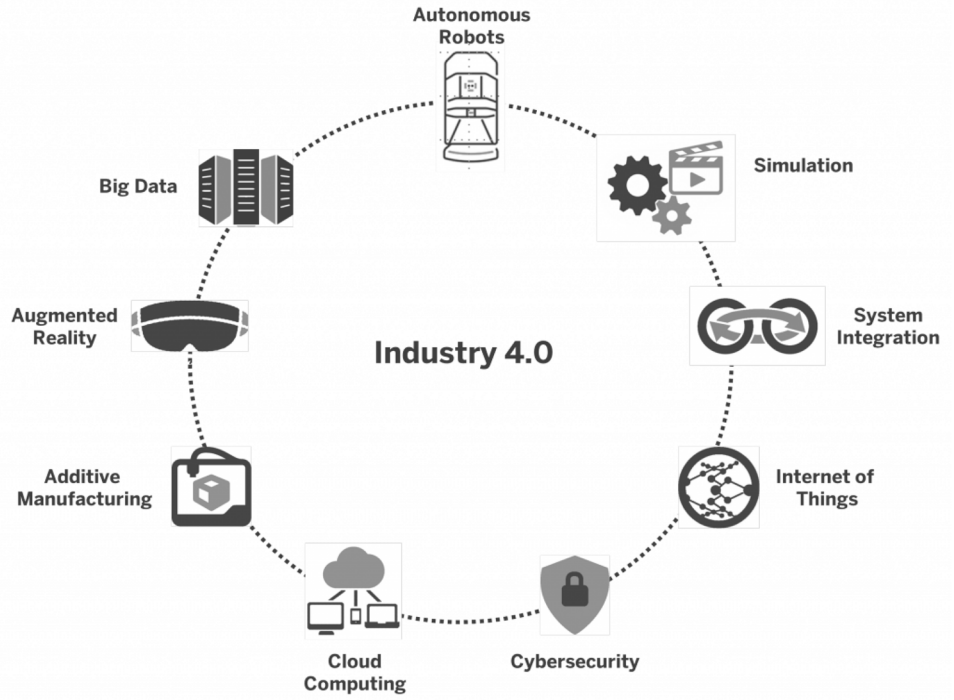
Figure 2. Structure of Industry 4.0
(Kesayak,2019)



- Internet of Things
- Internet Internet of Services
- Sistem Cyber-Physical Systems

Within the scope of the smart factories with modular structure with Industry 4.0, it is aimed to monitor the physical processes with cyber-physical systems, to create a virtual copy of the physical world and to make decentralized decisions. The internet of objects and cyber-physical systems will be able to communicate and collaborate in real time with each other and with people. The Internet of Services will provide both internal and cross-organizational services and will be evaluated by the users of the value chain.

Industry 4.0 aims to bring Information Technology and Industry together as a whole (Figure 2). The first of its major components is the New Generation Software and Hardware, which is low-cost, less space-consuming, less energy-efficient, less heat-efficient, but less reliable and different from today's classic hardware and operating and software systems that will run this equipment. The goal is to be frugal in terms of use. The second and perhaps the most important component is the Device Based Internet (Internet), which is used for the exchange of information and data with each other on the world. Cyber-Physical Systems. In the manufacturing process, the use of cyber-physical systems in the machines in the factories means mak smart factories de that can coordinate and optimize production by themselves, almost independently of people. If the Industry 4.0 strategy is realized, the amount of energy needed

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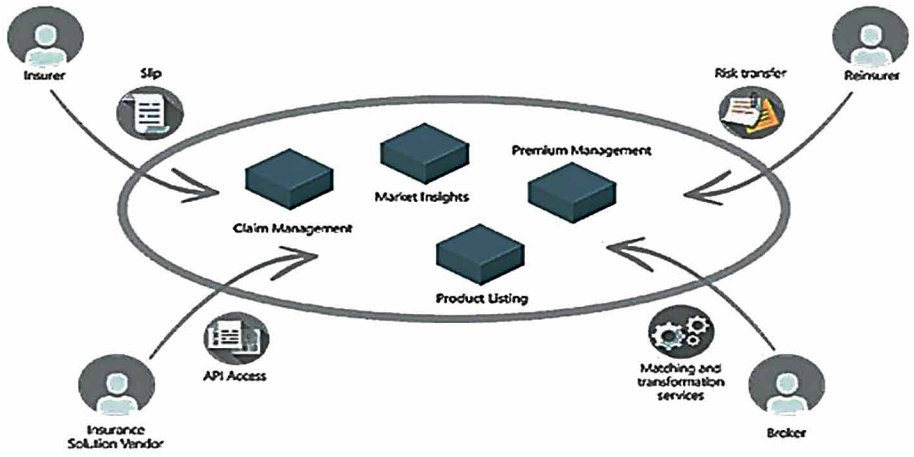
Figure 3. İnsurance System
(https://www.ixledger.com/solutions/)



for production time, costs and production will be reduced, production quantity and quality will increase (Kesayak, 2019).

INDUSTRY 4.0 AND INSURANCE SECTOR

Insurance according to the American Association of Risk and Insurance; Da It is the collection of incidental losses in a single pool by transferring the identified losses, transferring them to the insurance institutions agreed to meet other material damages related to the losses and the fulfillment of the risk related services esi (Rejda, 2008).

Insurance is one of the cornerstones of modern life. Without insurance, today's society and economy can become inoperable in many respects. The insurance sector protects individuals and companies from daily life and activities by protecting them against economic, climatic, technological, political and demographic risks (Insurance Europe, 2012). From this point of view, insurance is becoming an important part of life as a dynamic that creates an element of trust in economic and social life and contributes to the development of the capital market in the country with its capacity to create funds (Baltensperger and Bodmer, 2011).

Insurance can be classified in various ways with different perspectives. In this context, private insurance and social insurance are the most fundamental distinctions. Social insurance is the type of insurance that is implemented with the support of the state to provide assurance against a number of fundamental risks that the society faces. On the other hand, private insurance is an optional or compulsory insurance to transfer the risks inherent in real or legal persons.

In the insurance sector, there are many actors such as insured, insurer, insurance intermediaries, regulatory and supervisory agencies, insurance adjusters and reinsurance companies. The operation of the insurance system is given in figure 3.

People who need insurance and who have insured are called insured. The insured transfers the risk to the insurance company for a certain premium. Insurance contract between the insurance company and

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the insured is issued. The insured buys the insurance contract from the insurance company or insurance intermediaries. Insurance agents include insurance agents, brokers, banks, internet.

Industry 4.0 will affect all sectors in all areas and will affect the insurance sector as well. The insurance sector is a sector based on knowledge and marketing future risks. There are many factors such as the preferences of the insurance customers, the prices of the policies produced, the damage processes, the collection of insurance premiums, damage payments, insurance distribution channels. With Industry 4.0, the insurance sector will undergo transformation. Some developments in particular will directly affect the insurance sector. These;

- Machine Learning
- Internet of Things
- Artificial intelligence

Machine Learning in Insurance

Machine learning is mainly a sub-branch of computer science developed in 1959 from numerical learning and model recognition studies of artificial intelligence (Alkan, 2019). Machine learning is a system that learns the structure and function of algorithms which can learn as a structural function and make prediction on data. Such algorithms work by constructing a model to perform data-based estimates and decisions from sample inputs rather than strictly following static program instructions (Hasçelik, 2018).

The list of major concepts of machine learning is as follows:

- Supervised Learning: Data is organized in a specific order from interactive systems
- Unsupervised Learning: Examining the groups within the classless data
- Semi-Supervised Learning: This concept is precisely one of the above two concepts and is to use a small amount of data labeled with a large amount of unlabeled data.
- Reinforced Learning: An evaluation of the instructor, either right or wrong, for the outcome of the system.
- Intensive Learning: Also known as hierarchical learning. This learning method is a machine learning developed by a series of algorithms based on model attempts using high level abstractions in data generated from many linear and nonlinear transformations and multiple processing layers in deep graphs.

Machine learning as a scientific effort has historically emerged from the search for artificial intelligence. Some academic researches in the past have shown that machines have to learn data after a certain stage. In this way, researchers have carried out their studies in order to approach the problems that arise on this subject with various symbolic methods. Probabilistic logic technique was used especially in automatic medical diagnosis systems (Alpaydın, 2010).

Machine learning started to develop again in 1990 as a separate area. The goal of field change is to capture artificial intelligence in addressing the solvable problems in practical life. Machine learning and data mining often use the same methods and these methods overlap significantly (Bishop, 2016). These methods can be distinguished in general terms as follows (Raschka, 2015):

- Machine learning focuses on estimations from the learned data based on known features.

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- Data mining focuses on discovering unknown (historical) features in the data. This is a step in the knowledge discovery analysis in databases.

These two areas overlap in many ways. Data mining uses many machine learning methods, but mostly has a different logical goal. On the other hand, machine learning uses data mining methods such as unsupervised learning or pre-processing step to improve learner accuracy (Alpaydın, 2010).

The systems developed by machine learning will bring together a lot of information such as detailed data analysis and statistical analysis and will use this information to solve problems with certain methods. Now, the systems where the machines are used will be able to reveal the solution in the light of the data they analyze when new problems are encountered.

Insurance is one of the areas where data processing is considered to be the most advantageous in the world of finance. One of the most important factors that determine the financial lending position of banks or large companies is the guarantee of the debt given. Credit insurance acts as the guarantor. Machine learning algorithms can process millions of data and adapt themselves to changing conditions. Algorithms can be processed on samples of financial lending or insurance results that can process the data of a person or company to be insured. The results show that the machine learning practices for insurance companies are enormous. Nowadays, most insurance companies are now looking to develop machinery learning applications that will work together in environmental, demographic and factual situations in the analysis of the person to be insured.

Applications such as machine learning have theoretically possible to use in all areas where the actuarial is located. Technical pricing, creation of sales tariff, damage and misuse detection, risk management, insured /customer value management. However, the studies have focused mainly on pricing and have been a significant step in the creation of damage estimations and related price models.

Areas of Use of Internet of Things (IOT) in Insurance

In the past 20 years, industry-based robotics, intelligent sensors, cloud computing, cyber security etc. There are many technologies. The most important of these is the Internet of Things (IoT). This cycle focuses continuously on individualized customer requests and includes services from the product development and production order, starting from the idea stage, to the end user, including the distribution and recycling of a product to the end user. IoT consists of the initials of the Internet of Things statement. IoT is a network where objects can access the Internet and communicate with each other or with larger systems (Büyük and Öz. 2017). Almost all physical objects (automobiles, kitchen appliances, appliances, and even living things) can be connected to each other through IoT by means of one another or larger systems by providing access to the Internet. Nowadays, since most of the electronic devices are smart, more devices will be added to this list in the next few years (Çevdar and Öztürk, 2017).

Nikola Tesla, the famous scientist who doesn't find it suitable to make money from people through his inventions, said that the devices we use today will be replaced by smaller and more practical devices and this can be achieved by the transformation of the whole world into a giant brain when the wireless technologies are fully used. Years later, in 1991, IoT began to be implemented in Cambridge, England (Rouse, 2016).

Some physicians at the University of Cambridge went to an area outside the laboratory to meet their coffee needs, but each time they could go there, they couldn't go full. A solution to this situation is to place a camera on the front of the coffee machine (Kesayak, 2019). The image of this coffee machine

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connected to a single computer is sent to the computer screen, so that coffee is always consumed fresh. This application is considered to be an Internet of Things application because it is realized with online and real-time communication features (Gökrem and Bozuklu, 2016).

In 1997, Progressive Insurance pioneered the use of real-time online automobile insurance in the sector. The innovative approach of Progressive Company has broken the long-established commercial balances and has caused the shaking of traditional distribution channels in the insurance sector, which is a conservative sector, and the price transparency and strengthening of the customers (Canaan, 2016).

For example, an insurer can increase profitability directly by using the Internet of Things technology to transform the lost component in the income statement. Thanks to the Internet-based data of carefully gathered and analyzed insurers, insurance companies can move from defensive stance to more aggressive positions such as distributing the risk among policyholders and compensating for their losses. It can help policyholders to prevent losses and minimize claims / claims from insurers. By blocking the demands, it not only collects the returns of increased profitability, but can also reduce premiums and aim to improve customer retention rates.

Some of the real life and speculative examples are:

- Sensors placed in the infrastructure of commercial centers can monitor environmental hazards such as smoke, mold or toxic gases, allowing for environmental regulations, such as avoiding a potential hazard or at least reducing the effects of the hazard.
- Wearable sensors can monitor employees' movements in high-risk areas and send real-time data to employers, allowing employees to be warned of a potential threat and at the same time reduce the risk of fraud in workplace accidents.
- Intelligent home sensors detect the moisture in the wall and pipe leaks, and send an alarm to the landlord before the pipe explodes. This can save both insurers a large amount of reimbursement and the landlord of considerable inconvenience and irreplaceable damages. The same can be said for the Internet of Things sensors, which are placed on business properties and commercial machines. These sensors can also reduce property damage, employee and customer injuries, and loss of work interruption.

Artificial Intelligence and Insurance Sector

Artificial intelligence technologies are currently used in our work, in our car, in our home technology. Four technology trends that are closely tied to artificial intelligence are expected to lead the insurance industry in the future (Stefan, 2018). Artificial intelligence solutions, a unique blend of technologies such as machine learning and natural language processing, are expected to find more space in the insurance sector. Artificial intelligence technologies that continuously learn from the feedback from their users and the services that these technologies offer will greatly change the insurance marketing and insurance-client relationship, while helping to ensure high efficiency in the operational processes of insurance companies. Artificial intelligence and its associated technologies are expected to have a seismic impact in all areas of insurance, ranging from distribution to pricing and underwriting. Digital technologies and data are also today affecting distribution and underwriting, with real-time pricing and purchase of policies (Utkueri and Tamer, 2018).

Rapidly spreading of connected devices and data: Sensor devices are currently available in many industries, but in the following years there will be a large increase in connection rates with different

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devices (Ergun, 2017). Current connected devices develop very rapidly; clothes, glasses, home / kitchen appliance, medical tools and shoes will appear as many items that can be connected. These developments will allow companies to get to know their customers more deeply (https://www.metlife.com.tr/blog/sigorta/yapay-zeka-sigorta-sektorunu-nasil-donusturuyor/). Thus, both new product categories will emerge and personal pricing and real-time service delivery will increase rapidly. For example, a wearable technology linked to an actuarial database allows customers to calculate personal risks based on their daily activities. In this way, the likelihood and severity of the risks may be estimated.

Robotic expansion: There are many exciting successes in the field of robotics. This technology will continue to change how people interact with their environment. The three-dimensional printing technique will radically shape commercial insurance products in the future. By 2025, buildings constructed with three-dimensional printing will increase significantly and the risk assessment of insurers will change radically. In addition, autonomous drones, driverless vehicles, autonomous farming tools and surgical robots will become widely commercialized over the next decade (https://www.metlife.com.tr/blog/sigorta/yapay-zeka-sigorta-sektorunu-nasil-donusturuyor/). By 2030, the rate of driverless vehicles is expected to reach 25%. In addition, insurers will also have to understand how increasing robotic applications will change the risk pool, how they affect customer expectations, and create new products and channels accordingly (Kutsal, 2017).

Open-source and data ecosystem: In today's world, where data has increased more than ever before, open source contracts allow data to be shared and used between sectors. Various public and private organizations establish data sharing ecosystems for different uses under a regulatory authority and cyber security framework. For example, data can be transferred directly to the insurer through wearable technologies. Or home and car data can also be used by Amazon, Apple, Google and different personal device manufacturers.

Developments in Cognitive Technologies: Deep learning technologies used primarily in image, sound and unstructured writing processes will evolve in the future and can be used in much larger scale applications. These cognitive technologies will become the standard approach for processing data flows that are incredibly large and complex, produced by insurance products based on human behavior. With the increasing use of such advanced technologies in commercial life, insurers will be able to access models that adapt to the world around them by learning continuously. Thus, real-time products and techniques can be developed to respond to changing risks and behaviors.

INDUSTRIAL 4.0 AND EFFECTS ON INSURANCE SECTOR

The effects of Industry 4.0 are observed in almost all sectors. The sectors that felt the necessity of industrial digitalization were automotive manufacturing and supplier industry, white goods and electronics main industrial companies and exporter companies in these sectors. In addition, sectors such as software sector, logistics sector, insurance sector, aviation and industry sector and pharmaceutical sector are among the sectors affected by Industry 4.0.

The effects of Industry 4.0 on insurance are emerging. These effects can be listed as follows (Akansu, 2016):

- Emergence of online insurance markets and homogenization of risks,
- Innovative basic orientations (disaggregated distribution, driverless vehicles, shared economy),

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- The more unstable customers in an increasingly commoditized environment, the higher the risks, and in this case, gaining loyalty through innovation will become more important,
- It will become even more important for the institutions to perform better than their competitors because of the ability of customers to buy and compare. This will require insurers to increase the dimensions by expanding the scope or scale - together with the increased margin.
- The availability of networked devices at the same time allows insurers to personalize the insurance and proactively manage the risks of customers.

For example, telematics systems that can be implemented with wireless devices such as mobile phones or mobile phones; Wearable technology products and other intelligent systems that can be used by wearing or attaching to the human body will bring innovations to the business processes of insurance companies with the digital data they provide. Thanks to telematics systems, real-time data transmission and monitoring systems and motor vehicles can be monitored. Thanks to smart systems and wearable devices, insurance companies will be able to have information about their customers 'daily habits, so that companies can design offers that are tailored to their customers' needs. This situation will both contribute to the database of insurance companies and will establish a transparent bridge between the customer and the insurance company.

Chatboats, which can be defined as the introduction of artificial intelligence forms into our lives, are expected to take place more recently in the insurance sector. Chatbats will analyze what customers say in the future in a very short time and direct them to fulfill their wishes.

Nowadays, a motorcycle policy is calculated on the basis of some very basic criteria. The age of the vehicle, the age of the insured, the status of the damage, the province of the province, etc. factors affect the price of the insurance policy. However, hundreds of criteria such as the average speed of use of an insured vehicle, the percentage of entering the bad roads, and the use of faulty cars can cause the insurance policy to be lower or higher. At this point, it can produce different solutions by combining with technologies such as the internet of objects of the insurance industry. In this way, while companies gain more customers, users can get lower cost policy solutions.

In the future, the technological development of Industry 4.0 will further improve the insurance sector. For example, it will be possible to go beyond data such as occupation, gender, age, address, and access to data that is instant and continuously updated. In this context, data sharing models between technology companies and insurance companies such as Google, Facebook, Apple, Amazon, which have an intense database of individual data will be important. In addition, insurance models that provide the flexibility that the insurance companies cannot provide, and the start-ups developed will be in demand. For example, technologies such as calculating insurance costs, purchasing insurance on a trip or a holiday, or contacting the insured position with the insured in the relevant location are already developed.

How Will Artificial Intelligence Affect the Insurance Sector?

The following five examples illustrate how artificial intelligence will affect the insurance industry in the near and distant future.

- Customizing the Customer Experience
- Understanding Customer Experience
- Simplifying and Regulating the Demand Process

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- Fraud Prevention
- Improving Insurance

Customizing the Customer Experience: With the technologies like Robotic Process Automation, your relatively laborious jobs such as data entry can be taken from outside service providers. Artificial intelligence brings a new dimension to productivity and probability, especially for deepening customer engagement and relationships and promoting growth (Stefan, 2018). Today, insurance agencies are currently using artificial intelligence in customer service, in answering simple questions with chat robots, and in directing demands. In the future, employers can offer additional benefits with specialized chat robots that provide personal advice in health or medical counseling (Utkueri and Tamer, 2018).

Understanding the Customer Experience: When used in combination with other technologies such as artificial intelligence, Internet of Things, and machine learning, insurance agents can also provide insight into the behavior of customers and indirectly the risk (Stefan, 2018). For example, some vehicle insurers will be able to offer customers discounts on drivers with safe habits by placing sensors to track their driving.

Simplifying and Regulating the Demand Process: The demand process still contains information from more than one person. It is a fact that a traditional vehicle damage compensation process is completed by three to four persons and completed in 10-15 days. The demand process, which is not touched by the human hand, removes the people from the equation in many processes from artificial intelligence and robotic process automation to the examination of damage pictures, to communicating with customers and paying. The potential for artificial intelligence to accelerate the demand process can go beyond car insurance, and can be valid in life, disability, health and more (https://www.metlife.com.tr/blog/sigorta/yapay-zeka-sigorta-sektorunu-nasil-donusturuyor/).

Fraud Prevention: One of the most promising uses of artificial intelligence in the industry is the prevention of fraudulent demands. With the help of artificial intelligence and machine learning, computers can detect fraud and can produce better results (OECD, 2017).

Improving Insurance: Artificial intelligence technology also has the potential to improve by completely changing the insurance process. Machine learning can replace classical statistical risk measurement models and, without doubt, improve the industry to save hundreds of millions of dollars.

Artificial intelligence chat robots and other emerging technologies will affect the insurance industry. Brokers and agents will be able to obtain customer insights and engagement information that they have not previously had access to using these technologies. In this way, insurance companies can add value to existing customers by bringing the products and services they offer beyond collateral, to attract new ones and to increase their revenue at the end.

How Will the Internet of Things (IoT) Affect the Insurance Sector?

Insurance is one of the oldest sectors in the world. The idea of sharing risk came about 5,000 years ago when Chinese traders combined their cargo on many ships. The risk though; traders had insurance that their property would not be completely destroyed in case of the sinking of their ships (Çevdar and Öztürk, 2017). Although it is unlikely that today's consumers will trade in the seas, the basic method of insurance has not changed much. However, the insurance sector is drawn into the new modern age with the help of the internet of things. This technology has the power to transform insurance, but it also has its own challenges (Rouse, 2016).

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The process of insurance claims remained the same for many years, and it was not suitable for customers. Loss of customer resulting from reduced loyalty and unsatisfactory experiences; life, goods and accident insurance premiums correspond to high levels. Customers use technology in their daily lives and expect companies to do the same. However, IoT insurance companies are allowed to move faster and make data-driven decisions. Companies no longer have to deal with paperwork and can manage the demand process more efficiently.

Data from connected devices allows insurance companies to recognize their customers at a deeper level with more accurate personal information. This can help to create strong links with customers and to add a customization element to the insurance sector that has long been lacking. In addition, insurance companies can more easily identify fraud, propose personalized products, and make more accurate risk calculations.

The use of IoT helps improve insurance costs as well as improving customer experience. Automation can reduce the cost of the demand process by up to 30%. In many cases these savings can be reflected in the prices offered to customers (Kutsal, 2017). For example, an automobile insurance policy for your vehicle today is calculated according to some very basic criteria. The age of your vehicle, your age, accident-free status and your total history, the province you live in and from time to time your profession, the price of the insurance policy is effective. However, the average speed of your vehicle, the wrong way to enter the road, the wrong parking, incorrect turns, whether or not to signal the return of hundreds of criteria, may cause your insurance policy to be lower or higher. At this point, Insurtech solutions can be combined with technologies such as the internet of objects to offer different solutions to the market. Thus, companies gain more customers, while users can also receive lower cost policy solutions. Insurtech provides fast, flexible and different solutions to the insurance sector, while creating an opportunity for traditional companies to keep pace with its users (Yeniova, 2007).

Most insurance companies believe that connected devices and more data will prevent greater losses. This can reduce the number of claims and lower insurance prices for less risky customers. With the data obtained from the devices in health insurance, the health of a person can be monitored and the products and policies based on these data can be suggested. Many insurance companies; they think that adapting rich data-oriented applications without becoming widespread in the market will create a competitive advantage. Despite their increasing challenges, many companies are already accepting that IoT will make a revolutionary impact on the sector and customer experience. Taking advantage of the new IoT technology in a sector as regulated as insurance is one of the ways in which companies come forward and offer a forward-looking approach to their customers.

CONCLUSION

Digital transformation, directly or indirectly, shows its effect in all stages of our lives; it causes sudden and rising chaos. Therefore, change is not a self-sufficient process, but rather a cycle that continues with the emergence of new and partially destructive technologies. In recent years, companies operating in different sectors (especially banks) have been developing new strategies by feeling the threats created by the internet and they are promoting their customers to adopt digital solutions and promote their active use.

One of the most important preconditions for the realization of the Industry 4.0 revolution is that companies have completed their digital transformations. It is not possible for institutions that have not

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completed their digital infrastructure and have not been able to operate the company culture in harmony with digitalization.

The biggest aim of Industry 4.0 is the production of robots that can communicate with each other, detect the environment with sensors and realize the needs by analyzing the data and take over the production of these robots; to create better quality, cheaper, faster and less waste production systems. Industry 4.0 will bring together the Information Technology and Industry, and will enable more efficient business models to emerge because the intelligent factory system will be created and each data will be collected and analyzed in a good way.

By integrating modern information and communication technologies, such as Cyber-Physical Systems, Cloud Computing in the manufacturing sector to increase efficiency, quality and flexibility, it will allow you to analyze the possible yield conditions and gain an advantage in the competitive environment. With new generation software and hardware, which means low-cost, low-energy, low-energy, low-heat, but also highly reliable hardware, unlike today's classic hardware, with operating and software systems to run this equipment; perhaps the most important component, all the devices on earth are used to exchange information and data with each other.

The increasing acceleration of digital technologies in daily life has also begun to show its results in the financial sector. How financial actors have benefited from digital technologies was not among the topics discussed so far. Today, the financial market makers, especially the insurance sector, benefit from the technology and the conveniences they bring in taking into account the interests of their customers. In this respect, insurance technologies are introduced to insurance companies in many ways from risk calculation to pricing.

Industry 4.0 is expected to have an impact on the insurance sector, which is a knowledge-intensive sector in particular. Industry 4.0; change the impact of production on the environment, employment and education policies. New business models will be formed and mass productions will be carried out in a personalized manner. With the new industrial revolution, it will become even more important to insure the risks that may arise in the production processes. Personalized products will reveal the need for personal insurance. The insurance sector will require trained, qualified and competent insurance agents and insurance adjusters. Industry 4.0 will affect all sectors and will transform the insurance sector technologically. For example, it will be possible to go beyond data such as occupation, gender, age, address, and access to data that is instant and continuously updated. In this context, data sharing models between technology companies and insurance companies such as Google, Facebook, Apple, Amazon, which have an intense database of individual data will be important.

In addition, insurance models that provide the flexibility that the insurance companies cannot provide, and the start-ups developed will be in demand. For example, technologies such as calculating insurance costs, purchasing insurance on a trip or a holiday, or contacting the insured position with the insured in the relevant location are already developed.

Industry 4.0 offers numerous opportunities and threats for the insurance sector. Smart policies will provide many opportunities such as shortening of damage processes, meeting the demands and demands of insurance customers, fair solutions. However, due to technological developments, it will affect the insurance sector negatively due to the employment of smart robots and technological processes.

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KEY TERMS AND DEFINITIONS

Autonomous Administration: Cyber-physical systems are the ability to make their own decisions within smart factories.

Cloud Computing: For computers and other devices, which can be used at any time and enabling shared computing resources between users, is the general name of internet-based information services.

Insurance: A connection agreement with an organization that deals with this business in order to compensate for any future damage that may be incurred by someone or something in return for a pre-paid premium.

Interoperability: The ability of cyber physical systems (e.g., workpiece carriers, assembly stations and products) to involve people and smart factories through the internet of objects and the internet of services to communicate with each other.

Modularity: Provides flexible adaptation system to intelligent factories for changing requirements of individual modules.

Real-Time Capability: Ability to collect and analyze data. This structure makes fast understanding.

Service Orientation: Cyber-physical systems, people and smart factory services are offered via the Internet of Services.

Virtualization: This structure is a virtual copy of smart factories. The system consists of connecting sensor data with virtual plant and simulation models.

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Chapter 15
Future of Education in Industry 4.0:
Educational Digitization – A Canadian Case Study

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ABSTRACT

With the developments in technology and innovation, the manufacturing, workforce, training, and educational systems were affected. Facing the fourth industrial revolution, academics are researching the possible changes that might arise in education and skills of the future workforce. As the workplace develops, new competencies will surface. With this context in mind, the authors initiated this research. A detailed questionnaire was prepared as a pilot study to comprehend students' views on the use of technology in classrooms and its impact on their learning experience and engagement. Knowledge of their views allowed the authors to draw inferences as to the skills and competencies of future students and whether they would match Industry 4.0. Furthermore, a gap analysis was conducted, whereby the existing situation at a Canadian higher educational institution was compared to the desired situation, and recommendations were put forward.

INTRODUCTION

Industrial revolutions were affected by the developments in technology and innovation. The 1st revolution was caused by mechanization, the 2nd was caused by the usage of electrical energy, and the 3rd industrial revolution was caused by electronics and automation (Benešová and Tupa, 2017, p.2195-2196). With these industrial revolutions not only were manufacturing systems affected, but also the workforce, training & educational systems.

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Currently, industry is transforming to a fully digitized manufacturing system, and we are facing the 4th industrial revolution, Industry 4.0. With this new industrial revolution, the workforce and the training & educational systems will be impacted. This led academics to research the possible changes that might arise in the education and skills of the future workforce. Future workforce who are today's students will encounter a more globalized, automated, virtualized and networked world (Motyl et al., 2017, p.1502). As the workplace changes rapidly, new competencies will surface, rendering them essential skills for student competitiveness and employability in the near future. With this context in mind, the authors decided to initiate this study, whereby those new competencies and skills will be researched, and recommendations given as to the required changes in the higher educational system.

INDUSTRY 4.0

Developments in both technology and innovation are the main factors affecting industrial revolutions, and these revolutions have brought about significant changes in our way of working and living. Throughout history there have been three industrial revolutions and we are currently undergoing a transformation towards the fourth industrial revolution.

Industry 1.0 exchanged the human power with the power of steam. When James Watt introduced the steam engine in the 18th century, with the mechanization, production and the transportation systems transformed. Consequently, there was an important increase in productivity.

Industry 2.0 was caused by the electrical energy and the mass production about a hundred years later. When Henry Ford introduced the assembly line, with the mass production and the usage of electrical energy, there was a significant decrease in costs and a further increase in productivity.

Industry 3.0 was in the 1960s and came with the introduction and usage of computers, which introduced the world to a faster and more capable form of processing capability. This marked the beginning of the information technology era for industry.

Industry 4.0 refers to the next developmental stage in the manufacturing industry, and was first introduced by the initiative made by academics, industrials and the German Government. Its aim is 'to strengthen the competitiveness of manufacturing industry in the country by computerization' (Baena et al., 2017, p.74).

With this high-tech strategy, which converges the industrial production and information and communication technology (ICT), industry is going through a transformation to full digitization and intelligent production. In this concept, the Internet of Things (IoT), the 'Industrial Internet', 'Cloud-based Manufacturing' and 'Smart Manufacturing' are stated as the drivers of Industry 4.0 (Erol et al., 2016, p.13).

Hermann et al. (2016) defined Industry 4.0 as: "Industry 4.0 is a collective term for technologies and concepts of value chain organization."He further explains that; within the smart factories of Industry 4.0, cyber physical systems (CPS)will monitor the processes, and make decisions while communicating and cooperating with other cyber physical systems and humans in real time. In addition, with the Internet of Services (IoS), both internal and cross organizational services will be utilized by participants of the value chain (Rossit et al., 2018, p.1).

Similarly, Gilchrist stated that "businesses will build global networks to connect their machinery, factories, and warehousing facilities as cyber-physical systems, which will connect and control each other intelligently by sharing information that triggers actions" (Gilchrist, 2016, p.195). These cyber-physical systems will then generate the enhancements in the manufacturing processes as a whole, through engi-

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neering, material usage, supply chains and product lifecycle management which is called the horizontal chain. According to Gilchrist; "the vision held is; embedded horizontal systems are integrated with the vertical business processes, (sales, logistics, and finance, among others) and associated IT systems" (Gilchrist, 2016, p.196). As such, Industry 4.0 will not only change the manufacturing processes, but also the entire value chain, including the suppliers, the manufacturers, and the associated workforce.

Erol et al. (2016) advises that to identify their actions or projects in order to adapt to the changing environment, companies need to know where they are, identify their current situation with regard to Industry 4.0, but companies usually face problems in determining their state. Based on different research sources, there are some models and roadmaps that have been suggested. Schumacher et al, (2016) discussed the German Government's model for assessing Industry 4.0. There are nine dimensions which include; strategy, leadership, customers, products, operations, culture, people, governance and technology. Additionally, as Tortorella and Fettermann (2018) quoted from Chukwuekwe et al. (2016), the vital drivers of Industry 4.0 are suggested as; cloud computing, 3D printing technology, CPS, Internet of Things (IoT), Internet of Services (IoS) and big data. To move forward with Industry 4.0, companies should comprehend what these concepts mean to their business and how they might lead to a total transformation through a step-by-step analytical approach.

Now, there is worldwide effort and progress to improve the efficiency and productivity in manufacturing processes by integrating the latest developments in information and communication technology (ICT). Initiatives to link the ICT in the industrial manufacturing systems are being carried out in some of the most advanced economies (Baena et al., 2017, p.75). Despite all of Industry 4.0's promise, a highly skilled workforce has been the key factor to countries' and companies' success for decades, whereby significant challenges are being faced in hiring and retaining the necessary skilled workforce. Organizations understand that the changes that are associated with Industry 4.0 also alter the competency requirements of the highly skilled workforce. Many government institutions have started to evaluate the impact of adopting the aforementioned technologies on their countries. The result is a concern for the many challenges and changes in the future training needs and education of the workforce.

SKILLS NEEDED IN INDUSTRY 4.0

When talking about the 4th industrial revolution, it is said that factories are becoming more intelligent and flexible, and different sub-systems will be linked to each other (Wermann et al., 2015, p.1). Machines will be connected to the factory IT systems, which will in turn be linked to other parts of the value chain such as plants, fleets, networks and human beings, and will continually share information about the level of stocks, troubles, difficulties or faults encountered, and/or modifications in the orders. This means there will be full traceability which will bring about the possibility of improving the overall product and service quality (Deloitte, p.8).

Based on the changes in the manufacturing processes, various jobs will disappear and many new jobs will emerge. Industry will face the extinction of physically demanding positions as these jobs will be replaced by machines (Benešová and Tupa, 2017, p.2200-2201).Erol et al. stated that future employees will focus on creative, innovative and communicative activities rather than routine activities, as routine activities including monitoring duties, will all be performed by machines (Erol et al., 2016, p.14). Consequently, the key factor in the success of these intelligent factories will be the skills and the qualifications of their workforce.

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Hecklau et all. categorized the competencies in Industry 4.0 into four main groups; (i) technical competencies (state-of-the-art knowledge, technical skills, process understanding, media skills, coding skills, understanding IT security), (ii) methodological competencies (creativity, entrepreneurial thinking, problem solving, conflict solution, decision making, analytical skills, research skills, efficiency orientation), (iii) social competencies(intercultural skills, language skills, communication skills, networking skills, teamwork skills, negotiation skills, ability to transfer knowledge, leadership skills) and (iv) personal competencies (flexibility, ambiguity tolerance, motivation to learn, ability to work under pressure, sustainable mindset, compliance) (Hecklau et al.,2016, p.4).

Motyl et al. categorized the skills of engineers into two categories; (i) hard skills (including numerical and higher mathematical knowledge; problem solution skills, creativity and design skills; researching and experimenting skills, information processing, computer programming, and know-how of using specific software, awareness of industry standards, and comfortable with using computers) and (ii) soft skills (strong analytical thinking, communication, teamwork and leadership skills)(Motyl et al., 2017).

According to Erpenbeck and Rosenstiel, Erol et al. categorized the workforce competencies for the future production systems like; (i) personal competencies (solution-oriented attitude; creativity, out-of-the-box thinking), (ii) social/interpersonal competencies (teamwork skills; negotiation skills, role taking and making skills), (iii) action-related competencies (problem analysis and solving; data analysis and interpretation; method, tool selection and use) and (iv) domain-related competencies (application of lean thinking and methods in manufacturing; application of conceptual modeling methods, e.g. data flow, material flow and process modeling; application of Information and Communication Technology for material tracking and worker tracking) (Erol et al., 2016, p.14-17).

In the World Economic Forum (WEF) "The Future of Jobs" report, ten key skills which will be in demand by future companies were listed. The qualifications were not classified but most of them are soft skills, the skills listed are: complex problem-solving, critical thinking, creativity, people management, coordinating with others, emotional intelligence, judgement and decision-making, service orientation, negotiation and cognitive flexibility(WEF, 2017).

Moreover, as technological developments are evolving at a very high-speed, it is certain that digital literacy will be the key skill that everyone should consider as an asset in the era of Industry 4.0. As a matter of fact, in addition to all these skills and qualifications listed, many researchers have stated that digital literacy will be an essential and primary skill for the future workforce (Motyl et al., 2017, p.1502-1503).

Digital literacy consists of all the skills that are related to the digital world. After a review of existing literature, Do & Huynh (2017) described digital literacy as "capabilities ranging from technical skills (such as those used in coding), to digital citizenship, to the ability to identify fake news". Cain & Waller (2018) also suggested that future workforce must have 'digital dexterity' which is defined as 'the ability and desire to use existing and emerging technologies for better business outcomes'. While the digital literacy and digital dexterity demanded from the workforce will certainly differ across the sectors and the professions, as people have been the heart of all digital business transformations, only the most digitally dexterous will thrive.

Rapid digitization has made digital literacy essential for today's and tomorrow's workforce. This means that both current workers whose jobs will be automated and may become obsolete, and also today's students who will be the future workforce will be affected. Many new jobs will be generated and many will adjust to include a greater degree of interaction with digital technologies. It is anticipated that a basic level of digital literacy will be necessary for the majority of the workforce, and demand for advanced level of digital literacy will rise (Huynh & Do, 2017, p.9).

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In a time of precipitous change due to heightened technological developments, Huynh and Do further explain that, digital literacy can be recognized as an economic necessity (Huynh & Do, 2017, p.9). Developments in technology are leading industries to redesign their operations, their markets, their products, and their way of doing business, and even for low-level jobs, a basic level of digital literacy will be expected.

There is an increasing reliance on digital technologies across a wide range of industries, which will result in a broad range of career paths for the qualified workforce equipped with technical and digital skills.

According to all the researches and studies, it is definite that Industry 4.0 is more than the technology it is bringing. As workforce is a critical element in digital transformation, the skills and qualifications of the human capital will become increasingly eminent. Today's students, which will be the future workforce and the human capital for companies, will be working in a more globalized, automated, virtualized and networked world (Motyl et al., 2017, p.1502), and their digital literacy and dexterity will be the main mechanism that will empower organizations to utilize these critical digital developments.

As stated above, because the key factor will be the skills and the qualifications of the workforce, organizations will compete to hire the best and strive to find the right people with well-suited skills. The demand for these skills and qualifications will undeniably be higher when compared to the present. This will result in the need for changing and adapting the existing curricula and the tools used in the existing educational system to create a new format (Benešová & Tupa, 2017, p.2196) or blueprint, which will equip students with the essential employability skills required to remain competitive in industry 4.0.

FUTURE OF EDUCATION

Education is regarded as an essential prerequisite and a foundation to reforms in any country (Nafea & Kilicarslan Toplu, 2018, p.156). Education evolves in response to changes in both society and industry, providing the valuable human capital that organizations need to thrive in the future. As such, upgrading and modernising educational systems through revisiting the essential employability skills is imperative. Interestingly enough, this upgrade is long overdue and has been called for since the late 90s when researchers realized that school systems, public and private, are lagging behind the transformation in learning that is evolving outside them (Ives & Jarvenpaa, 1996, p.33).

Analyses and predictions about the future of work mostly put forward the impact of automation and new types of jobs, and not just routine jobs, both blue-collar and white-collar jobs will be affected and redesigned by an automated workplace. Apparently, today's students should be prepared for the careers that do not exist yet. This means that with new challenges arising in a changing environment, there will be proliferating demand for new skills and qualifications (Enke et al., 2018, p.272). As Erol et al. stated in the last decade, lean management was the most prominent subject that was taught, however, for the future prospective digitalized and intelligent production systems' focus should be on the demanded skills and qualifications (Erol et al., 2016, p.13). In order to meet the qualifications and skills of Industry 4.0, educational systems need to evolve, and consider several promising trends like Elbestawi et al. listed: "opportunities to learn at diverse times and places; personalized learning based on student's capabilities; use of new learning devices, tools and resources; remote engineering labs; implementation of project-based and problem-based learning approaches; use of experiential and collaborative learning; student involvement in curriculum design; and increased mentoring approaches" (Elbestawi et al., 2018, p.252).

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With the new improvements and developments in technology and the expected changes in the workplace, there is also a shift toward more practical and skills-based education. Many higher education institutions try to prepare their students for the change through emphasizing the ability to use theoretical knowledge in practice by bringing real-world experience into the higher education experience and by providing access to the tools, environments and work methods that students will use when they graduate and start working (Morgan & Thayer, 2018). Yet the question remains, is this theoretical knowledge sufficient to induce the required change and instil the needed skills?

When Industry 4.0 is taken into consideration, future engineers need to enhance their professional, social, methodical and personal competencies. According to Simons et al. "they need an interdisciplinary understanding of systems, production processes, automation technology, information technology, ergonomic principles and business processes" (Simons et al., 2017, p.83). While future engineers will have a broad view and comprehensive knowledge about complex production systems, they also need to develop the skills needed for cooperation and communication in interdisciplinary groups. Although there are different approaches like seminars, business games and case studies where students meet the managers to solve existing problems, learning factories have been advised by many researchers (Enke et al., 2018, p.267-268; Chryssolouris, 2016, p.46-47; Mavrikios et al., 2013, p.475-478; Schallock et al., 2018; p.28).

Learning factories can be accepted as forms of real factories which are used for education and training purposes. When the possibilities of practical application of manufacturing principles are evaluated, learning factories have been a vital facility for educating students and professionals. As Baena et al. (Baena et al., 2017, p.74) quoted, learning factories are highly complex learning environments, which allow the advancement of competences (Tisch et.al, 2015), that are linked to training, education and research in favour of Industry 4.0 (Abele et al., 2015).

The aim of learning factories has been stated as modernizing the learning process and bringing it closer to industrial practices. They are an important way to practice technical knowledge and have been used for educational purposes, training and research. They allow learning of the fundamentals of industry 4.0 such as cyber-physical systems, smart factories, robotics, artificial intelligence, and internet of things (IoT) (Elbestawi et al., 2018, p.250). As technological developments speed up, learning factories are being used at a more rapid rate by higher educational institutions that are constantly struggling to find new ways of connecting theoretical knowledge to practical implications by using real cases and onsite technology (Mourtzis et al., 2018, p.130).

As an example; the learning factory at the W. Booth School of Engineering Practice and Technology at McMaster University in Canada provides students, industry employees, and researchers; an experiential learning laboratory that allows and empowers its users to understand, learn and apply modern manufacturing approaches such as Industry 4.0, IoT, and additive manufacturing (Elbestawi et al., 2018, p.254).

Education and training the workforce for industry 4.0 is something that has to be addressed across all levels of education. As technology is rapidly shifting the way industries and companies interact and function, higher education institutions should also alter the way they train and teach students in preparation for the future. Instead of focusing on theory, educational practices should emphasize application and experiential learning. The competences required to succeed in industry 4.0 should become part of vocational education. Also, it can be expected that degree apprenticeships and co-op programs with internships will become more and more attractive in the future. Higher education institutions at large are urged to respond much more quickly to the pressing need of preparing tomorrow's workforce (WEF-2017, p.8-9).

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Having said that, according to recent studies, although there are many skills that have been put forward by many researchers, the most vital and primary skill seems to be digital skills. Future workforce must be highly proficient in digital literacy skills in order to understand, manage and work in the system. The future workplace will require extensive and continual encountering with technology. With this in mind, technology should be embedded throughout the educational experience. Besides the basic digital literacy skills, educational institutions should aim to go the extra mile and coach students on how to apply and innovate using technology so they can play an active role in shaping the tools of the future (WEF-2017, p.8-9).

Preparing the future workforce for the digital world with advanced knowledge and requisite skills must be the future plan for all educational institutions across the world. Canada's continued economic growth will also require a digitally literate workforce for both technical and non-technical jobs. That's why the Information and Communications Technology Council (ICTC) defined five key technologies which will steer change in the Canadian economy: (i) virtual and augmented reality, (ii) fifth-generation mobile technology, (iii) 3D printing, (iv) blockchain, and (v) AI. Citing from ICTC 2017, Walker et al. (2018) stated that many of these mentioned, recent technologies are well on their way to transforming industries like transportation, financial services, manufacturing, retail, robotics and e-commerce etc. (Walker et al., 2018, p.5154).

Technological advancements are leading industries to change their operations, their markets, their products, and their ways of doing business. In order to adapt Canadian graduates to work effectively across these industries, equipping them with a range of digital skills is critical.

RELATIONSHIP OF TECHNOLOGY TO WORKPLACE READINESS

Literature suggests that there is a strong relationship between technology and workplace readiness. Several countries have realized this connection and have been preparing their students accordingly for the past decade now. In a research based in the USA by Piliouras et al., the authors wrote about their experiences that they learned by using and teaching technology at the Academy of Information Technology (AITE) High School. AITE is a public high school that offers its students a technology-rich learning environment. The researchers refer to a large-scale survey of employers conducted by the US. Department of Labour in 1989 to find the most important workplace skills and competencies. They identified three skill types and five attributes as essential competencies. These attributes included technology proficiency, which they defined as "the ability to use a variety of technologies to solve problems, and to select, use, troubleshoot and maintain technology related software, hardware and systems". Using these results, the authors expanded their research model to include Information Literacy, Media Literacy and Information and Communication Technology (ICT) literacy. Based on the directives released by the US Secretary of Education in 2010, the report identified five goals that need to be addressed at a national level to recreate the education system. One of those cornerstones was "infrastructure: access and enable, which states that all students and educators must have access to a comprehensive infrastructure for learning when and where they need it" (Piliouras et al., 2014).

The article (Piliouras et al., 2014), goes on to provide empirical evidence on the use of technology as a learning tool in a high school in Stanford, Connecticut that serves around 650 students. The school provides a dynamic preparative environment that incorporates 21st century learning expectations based on the National Education Technology Plan (NETP) of the USA. The research documents teacher's and

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students' experiences with the use of technology throughout high school and concludes with a series of 'key lessons' including that technology is essential because it helps students access information in a faster and quicker way, making them more efficient and effective. It can also aid students in choosing future careers and envisioning possibilities in technology-related disciplines. It can "significantly improve communications between teachers and students." Finally, they concluded that "when directed towards a common goal, technology experiences can help students develop soft skills – such as helping others, teamwork, collaboration, and group research. Peers can teach each other difficult subject matters using strategic learning [and] schools can encourage learning after-hours by supporting technology clubs and activities that develop technology and work readiness skills".

The research also stresses the importance of having a learning management system (LMS) from an early age and its role in facilitating the on-going assessment of learning outcomes. More importantly, LMS provides a virtual learning environment that makes it easier to reach a larger and more diverse audience, thereby creating a respectful online culture, which allows students to express themselves freely and without judgement. This has several advantages when compared with the traditional, physical setting, where students are more conscious of their surroundings and each other's behaviors, which may present a distraction to their learning process. Although the paper supports the use of technology in education and provides evidence that this model is followed by other high schools in the US as steps are being taken to achieve the National Education Technology Plan, it fails to outline how technology is used by students with certain disabilities and if measures are being taken for their accommodation.

In Germany, the situation is slightly different. A research conducted in the University of Oldenburg to gain an understanding of the situation in Higher Education institutions is presented. Bond et al. (2018), have examined student's (n=200) and teacher's (n=381) perceptions on the use of digital tools, in light of the importance of digitization recognized by German policy makers. Bond et al., state that nearly all (99.4%) of German school students have a computer at home. On average weekdays, students spend 114 minutes using technology at home, but they only spend 14 minutes using technology at school per day, which is lower than the OECD average. The authors provide evidence that the German government seems committed to the digitization of the Higher Education sector through their allocation of a hefty budget and commitment to a national digital agenda from 2014 to 2017. Authors also inform that digitization is accepted as a way to facilitate knowledge sharing and innovation in science by the federal government. In addition, the federal government also expects its citizens to be digitally literate to fully participate in education and society (Bond et al., 2018).

The university being researched was established in 1973 and houses over 15,600 students and more than 1,900 faculty. University top management believe in an institution-wide implementation of digitization to enhance on campus learning. The researchers used two separate surveys addressing the same issues to collect data from both students and teachers. Similar to our research, the results were descriptive in nature and were not compared statistically. The teacher research was conducted over 6 different faculties / colleges using a Likert scale similar to ours. Results showed that the use of learning management systems and related discussion forums was the predominant form (80%) of technology used on campus. Other tools, including, collaborative reference management software (61%), video-conferencing tools (52%) and institutional cloud storage (62%) were moderately used. On the other hand, student perception showed a different truth… Use of computers off campus and Stud.IP on a daily basis accounted for 84% of students. Yet, other tools, such as instant messaging and lecture recording were found to be used rather irregularly. According to the authors this shows that; tools like virtual seminars, online exams and professional networks are not used frequently. They also state that; with the data collected, it is not

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possible to say why these tools are not being used. It may be because of not wanting or not being able to use the tools (Bond et al., 2018). Findings show that the use of technology is centered around the use of 'logistics in university study' rather than content creation or collaboration activities. Students were found to be ill-prepared for working in collaborative environments.

This aligns with findings from another study by Margaryan et al. (2011), which focused around the use of educational technology by university teachers in the UK. The results reveal three main issues: "a lack of digital skills, systematic problems, and a reluctance to change". Accordingly, recommendations in both researches seem to be similar… Ongoing professional development sessions must be made available to faculty to learn and experiment with the applications and benefits of new technology. Forums should be held where faculty members can discuss their experiences with new tools, learning lessons and tricks. This will encourage knowledge transfer between faculty members and create a network of shared experiences and best practices. This can also be done through the creation of forums where constant, on-going, unfacilitated discussions can take place. Finally, educational institutions need to provide incentives for the use of technology tools in classrooms to create a more advanced and digitized learning experience for students. Finally, top management support is imperative for these initiatives to succeed. Digitization needs to be part of the strategic outlook of colleges and universities. It needs to be transformed into the core competency of higher educational institutions.

RESEARCH ANALYSIS AND FINDINGS

With the afore-mentioned literature in mind, it was obvious that the external stakeholders of educational institutions including industry partners and suppliers are demanding a more digital and competent workforce. As such, it was imperative that the authors understand and gauge the viewpoints of the internal stakeholders of the educational process – namely students. Accordingly, a detailed questionnaire was prepared as a pilot study to comprehend students' views on the use of technology in classrooms and its impact on their learning experience and engagement. Knowledge of their views can allow the authors to draw inferences as to the skills and competencies of future students and whether they would match industry 4.0. Furthermore, a gap analysis between the employability skills and the current situation can be conducted, whereby the existing situation at Canadian educational institutions can be compared to the desired situation and recommendations can be put forward.

Parts of the questionnaire used were extracted from the 'Technology Implementation Questionnaire'. This questionnaire is part of a project conducted by the Centre for the Study of Learning and Performance (CSLP) at Concordia University in Montreal, Quebec in collaboration with the Eastern Townships School Board and the Sir Wilfred Laurier School Board. Studying classroom processes in cooperation with the teachers, the students and the administrators, is one of the goals of the CSLP.

The questionnaire compiled by the researchers was distributed to 112 students in a higher educational institution in Toronto, all pursuing a 4-year bachelor program in the area of International Business or Commerce. The sampling method used was a convenient sample since the population sampled was accessible by the authors given their profession as university / college professors in Toronto, Canada. Nevertheless, there was minimal interference by the researchers in the data collection phase. A detailed information letter, and consent form were prepared for student review and approval. Participants were made aware that participation was on an anonymous and voluntary basis. The questionnaires were linked

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with an alpha-numeric code to a master list safekept with one of the primary researchers. All data was transformed into digital format and hard copies have been destroyed for security and anonymity reasons.

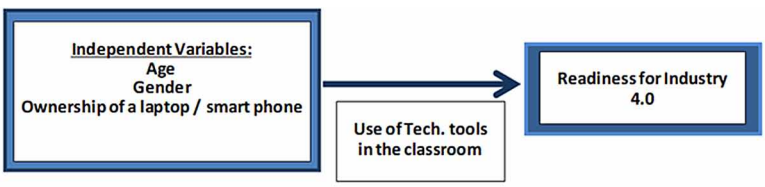
The questionnaire was divided into two parts. The first part was designed to collect some primary information about the respondents including their age and gender, followed by four questions designed to gauge the respondent's familiarity with the use of different types of computer and information technology hardware and software as well as some terms associated with technology. Since this is a pilot study that might be redefined in the future based on the results of the current questionnaire, the authors have decided to use 'Readiness for Industry 4.0'as the only dependent variable to be studied with the use of technology tools in the classroom as the moderating variable and three main independent variables as shown in Figure 1.

The age of the respondents ranged between 20 – 40, with 67% (75 students) of the participants within the age of 20 – 30 years and 33% (37 students) between 30 – 40. The gender distribution of the convenient sample was 72% women (80 students) and 28% males (32 students), which may be an indicator that females are more proactive and seize the opportunity to get their voices heard. More inferences will be made between gender and age and the moderating and dependent variables mentioned above as the questions are analyzed in detail. The first question asked students to indicate which of the given devices (desktop or laptop; smart phone; tablet; e-book reader; MP3 player; video game console; other) they owned. It was important to understand the level of technology students and millennials deal with on a daily basis and are exposed to. This will give us an indication as to their comfort level with technology.*90% of participants (100 students) indicated they owned a desktop / laptop, 100% of students own a smart phone, 36% (40 students) own tablets, only 9% (10 students) indicated that they owned readers and finally 24% (27 students) indicated their ownership of a video console game of some sort. It is worth noting that all 27 students were males!* No female participants indicated ownership of a video console.

Following this knowledge, participants were asked which activities they perform regularly by checking all that apply. Activities were listed as: Sending an e-mail; Using Office applications (Word, Excel, PowerPoint, …); Reading and downloading documents from the web; Doing web/ internet research; Managing a website, wiki or blog; Using collaborative and sharing application like Google drive, Dropbox, Skype; Using social networks (Facebook, Twitter,…); Other (please specify one or more activities).

According to a report issued by Contact North in November 2015, understanding the current and future dynamics of the higher education system is important, especially for those leading the system or developing the policies which guide it. The report discusses seven trends and patterns which will impact the future for colleges and universities by 2030. The report discusses changes in Canadian higher education in the context of changing global education trends as student recruitment and retention patterns change and become more competitive. According to David Agnew, current President of Seneca College, and Chair of Colleges Ontario, one of the factors impacting the shift in higher education is the

Figure 1.



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enhanced implementation of technological developments. In his speech, he identified that in the past "the barrier to accelerated adoption of such technologies was the willingness of faculty members and instructors to utilize them", while now there is a competitive necessity that students are exposed to such forms of technology for their survival as well as the institution's. *All 112 students indicated that they regularly perform all of the above activities except managing a WIKI, Blog or Website, where only 22% (25 students) indicated they engage in this activity.*

Since we are focusing on industry 4.0, the researchers added a few more questions to discern the importance of technology for participants. As such, questions 3 and 4 addressed the level of importance participants attribute to interaction with their teachers, even during class, using personal digital devices. *90% of students felt it was very important, while the remaining 10% chose important*. The final question pertaining to section 1 included a list of 15 "digital innovations", where students had to identify, using a five-point Likert scale (Yes, often; Sometimes yes; Seldom; Very Rarely; Never), if they had ever heard about these terms before. The terms asked were: Virtual Realty; Augmented Reality; Mixed Reality; Rapid Prototyping; 3D Printing; FABLAB; Industry 4.0; Smart factories; Artificial Intelligence; Internet of Things; Industrial Internet; Cloud-based Manufacturing; Augmented Reality; Cyber-physical Systems (CPS); Big Data and Analytics.

These innovations are in line with President Agnew's speech, where he stated that technology will continue to evolve in such a way to make learning more personal, affordable, effective and accessible. In the future, institutions will respond by more rapid adoption in line with student behaviour. *It is important to note that all students stated that they had heard of 8 of the above terms 'often'*. This is imperative when one examines Ontario employability skills #6 and #7, to locate, select, organize and document information using appropriate technology and information systems; to analyze, evaluate, and apply relevant information from a variety of sources respectively. For students to be competitive in a dynamic world, their education needs to provide a solid foundation for them to discover, learn and grow.

The aim of the above question was to ensure students were current and had heard of some / majority of the above terms in school, whether it was through class lectures and discussion or perhaps assigned class readings. *It is worth mentioning that the 2 terms that were marked as 'very rarely' or 'never' heard by everyone were FABLAB and Cyber-physical systems*. Perhaps this was due to the technical nature of the terms and the fact that they were more related to the engineering / manufacturing disciplines as opposed to the business field. In a paper titled "Effective communication in higher education", the author discusses some of the problems faced in communicating with the millennial generation. Howard states that since the millennial generation is entering the workforce, this specific group will be looked upon as a possible reason communication in higher education is lacking at the moment (2014, p.3). Howard explains that students have grown accustomed to dealing with technology and a virtual world that they may lack the proper etiquette when communicating with others in an organizational setting. She postulates that this may lead to organizational culture issues in the future and may also be the reason why communication in higher education institutions is not where it should be today.

The latter reason is an interesting observation. From personal experience, educators feel that millennials have a false sense of 'entitlement'. Although their education style is different and more advanced compared to 20 years ago, technology has facilitated the education process and made information available 'on demand'. Accordingly, most students do not dedicate enough effort and commitment to their educational experience and simply 'cruise by'. This is why the researchers included questions 5-32 to investigate the use of technology in classrooms and draw some conclusions about its impact on the educational process and its readiness for education 4.0 through a gap analysis.

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The questions were divided into three distinct sets, and a five-point Likert scale (strongly agree, slightly agree, neutral, slightly disagree, strongly disagree) is used. The first set pertains to student opinions regarding the effectiveness of computer technology as a tool in the classroom including its impact on factors such as academic achievement, collaboration, communication, instruction and value. These factors should be compared to the Essential Employability Skills (EES) dictated by the Ministry of Higher Education and Skills Development as skills that should be reliably demonstrated by the end of a student's program that are essential for success in the workplace, everyday living, and for lifelong-learning. The employability skills have been divided into six main skill categories; namely communication, numeracy, critical thinking and problem solving, information management, interpersonal and personal.

We can see from below, that the first set of questions relates to communication (questions 4, 5 & 6), critical thinking and problem solving (questions 1, 2 &3), information management (questions 2 & 7), personal (question 8), interpersonal (question 4). Questions are:

The use of technology in the classroom…

1. Increases academic achievement (e.g. grades).
2. Results in students neglecting important traditional learning resources (e.g., library books).
3. Is effective because I believe I can implement it successfully.
4. Promotes student collaboration.
5. Makes classroom management more difficult.
6. Promotes the development of communication skills (e.g., writing and presentation skills).
7. Is a valuable instructional tool.
8. Is too costly in terms of resources, time and effort.

Interestingly enough, the results for all of the above questions, except for 2 and 8 *show that 70% (79 students) of participants agree with the above statements while only 30% (33 students) slightly agree*. These results are in line with the generational differences chart (http://www.wmfc.org/uploads/GenerationalDifferencesChart.pdf), which outlines millennials as a technologically savvy generation who are individualistic yet simultaneously group oriented. The above results show that participants value academic achievement in addition to collaboration and peer interaction. The chart also characterizes millennials, otherwise named 'Generation Y', as high achievers that like personal attention, which is why most of them agree that technology makes classroom management more difficult. They understand that although technology gives them an edge and additional skills before joining the workforce, it deprives them of a more focused attention by virtue of larger class sizes. Students mostly agreed that they can implement technology successfully (question 3) because they are 'a techno generation and high-speed stimulus junkies' that need to constantly be engaged and challenged in order to perform.

Question 2 seemed to provide a controversy, whereby 50% (56 students) responded that they strongly / slightly agree, 15% (17 students) were neutral, while 35% (39 students) seemed to strongly / slightly disagree with the statement. The researchers think that the difference in answers to this question stem from 2 factors… culture / ethnicity and gender. Culture is NOT a factor included in this research and will require further probing in future research, where ethnic origin is identified in the research parameters. Yet, since this is a convenient sample, the researchers hypothesize that students from Eastern origins are more accustomed to using traditional learning resources, perhaps due to their educational systems or the lack / delay in a technology infrastructure as opposed to Western nations. In terms of gender, analysis shows that 60% of those that slightly / strongly disagree with this statement are females. This might be

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associated with females having a greater attention to detail and hence their desire to read books / notes in further detail than males. *Question 8 shows that 100% of participants slightly / strongly disagree with the fact that technology is expensive in terms of time and / or effort*. If we relate this to the characteristics of millennials in the workplace, it seems to agree with their sense of entitlement, their need for creativity and flexibility and their willingness to take risks and make mistakes. If we cross-examine this with characteristics of technology at large, we will find a perfect fit. The use of technology in classrooms allows for flexibility since it entails working alone and in groups. It also allows room for error since it is based on 'learning by doing'.

The second set of questions focuses on the stakeholders involved in the use of technology – students, teachers and parents. Questions are:

The use of technology in the classroom…

1. Is successful only if teachers have access to a computer at home.
2. Makes teachers feel more competent as educators.
3. Is successful only if there is adequate teacher training in the uses of technology for learning.
4. Gives teachers the opportunity to be learning facilitators instead of information providers.
5. Is successful only if technical staff regularly maintains computers.
6. Demands that too much time be spent on technical problems.
7. Is successful only if there is the support of parents.
8. Is an effective tool for students of all abilities.
9. Is unnecessary because students will learn computer skills on their own, outside of school.
10. Enhances my professional development.
11. Is effective if teachers participate in the selection of computer technologies to be integrated.

For questions 1 to 6, 90% (101 students) of participants indicated that they strongly / slightly agree with the proposed statements, while the remaining 10% (11 students) either slightly disagree or are neutral. It is worth noting that there is a gap between the desired situation as indicated by students and the current reality. Given that both researchers are professors in the Ontario College system, it must be noted that a majority of instructors do not have adequate technology training, in large part due to their age and due to the lack of time dedicated to new technology training. With a heavy administrative and teaching course load, instructors are not always well prepared for the use of technology, which might explain why students agree that too much time is spent on technical problems. Although a large budget is spent on IT funding in Ontario Colleges, the influx of students is large, which sometimes causes the system to slow down. This justifies why students agree that technical staff need to regularly maintain and update computers.

Question 7 asks students about the support of parents in their technological education. Although parents are an important stakeholder in the educational process, given the financial support they provide and their role as secondary / primary decision makers in the schools and/or programs chosen by their children, it seems that participants do not feel that they have an impact when it comes to technology. *55% of participants (62 students) either slightly / strongly disagreed with this statement, while 45% (50 students) were neutral*. It is worth noting that gender did not have a bearing on the results of this question. It is worth noting that all participants in the convenient sample did not have any learning disabilities / difficulties, hence the researchers feel that the answers to question 8 are not representative and would be best tested in further detail with a larger, more inclusive sample. *100% of participants indicated that*

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they either strongly / slightly agree with technology being an effective tool for all participants. As College educators, the researchers disagree with this since most of the technology used is not customized to students with learning difficulties, this includes basic tools such as office, MS project and more complex tools such as simulations. All of the aforementioned are not designed according to inclusive learning and universal design standards. This includes simple add-ons such as captioning, audio guides, larger fonts etc. Hence, it is safe to say that there is a large gap in this regard.

When asked about the importance of technology in classes and whether or not it is a skill that can be acquired outside, participants' responses varied. 35% (39 students) indicated that they strongly / slightly agree, 10% (11 students) felt neutral, while 55% (62 students) stated that they strongly / slightly disagree. Given this disparity in responses, we analyzed the role of gender to find that of the 62 students that agreed with this statement, 53 were females (66% of the female sample). This correlates with the results of question 2 in the first set of questions when students were asked if technology would result in the neglect of traditional learning resources. *Researchers can draw a preliminary conclusion that females are believers in the traditional educational institution with the role of teachers and learning resources, be it technology and / or books, in providing new knowledge and laying the foundation of learning*.

Questions 10 and 11 show overwhelming agreement with the statements; 100% of participants strongly agree that the use of technology enhances their professional development. This is line with the characteristics of millennials, which indicates that Gen Ys prefer to learn in networks and teams using multimedia and digital media. They are also characterized as entrepreneurs with a high sense of responsibility, which explains why participants unanimously think that teachers should choose the technology to be integrated in their classrooms and courses. This is directly related to questions 1, 2 and 3 pertaining to teacher's competence, training and ease with the technology chosen.

The final question set, comprised of nine questions, deals with student's learning and interpersonal skills, as part of the Essential Employability Skills. Questions are:

The use of technology in the classroom…

1. Helps accommodate students' personal learning styles.
2. Motivates students to get more involved in learning activities.
3. Could reduce the number of teachers employed in the future.
4. Promotes the development of students' interpersonal skills (e.g., ability to relate or work with others).
5. Will increase the amount of stress and anxiety students experience.
6. Is effective only when extensive computer resources are available.
7. Is difficult because some students know more about computers than many teachers do.
8. Is only successful if computer technology is part of the students' home environment.
9. Improves student learning of critical concepts and ideas.

Questions 1 and 2 are important topics around which there has been a lot of buzz in the past decade. According to Dunn& Griggs (2000), "a learning style is the way students begin to concentrate on, process, internalize and remember new and difficult academic information". It is "a biologically and developmentally determined set of personal characteristics" grounded in cognitive style theory and brain lateralization theory". According to the VARK learning model, there are four main ways by which students learn – Visual, Aural, Read-Write and Kinesthetic. Technology falls into the kinesthetic domain,

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whereby students learn by doing. This includes real-life scenarios, case studies, group presentations (using office) and simulations. Technology is also part of the visual category, which includes maps, charts, graphs, diagrams, brochures, flowcharts, highlighters, different colors, pictures, and different spatial arrangements. The use of a variety of learning styles in class and during assessments motivates students to get more involved in learning activities. *100% of participants indicated that they strongly / slightly agree with both statements*. Although this is theoretically valid, the real-life situation in saturated classrooms, with no support provided from teaching assistants, is different. Teachers often do not have time to integrate different activities in their classes, rendering them dull and monotonous. As such, there has been an increase in the amount of complaints to higher management about teacher's performance, as millennials seek a challenging and dynamic educational environment. In this regard, there is a gap between the actual and desired situation.

Question 3 can be considered one of the concluding questions of this research. As a result of the use of technology and new instructional models such as hybrid and online courses, participants are asked whether they think technology could reduce the number of teachers employed in the future. Interestingly enough, the answers to this question were varied. *35% (39 students) of participants indicated that they either strongly / slightly agreed, 25% (28 students) felt neutral, while 40% (45 students) strongly / slightly disagreed with the idea.* Accordingly, the responses were analyzed based on gender. Again, of the 45 students that disagreed with the statement, 40 were females, which accounts to 50% of the surveyed female population. This finding seems to support our previous conclusion about female believers in traditional education.

Questions 4, 6 and 9 showed that 100% of participants either strongly / slightly agreed to all statements. Students feel that technology promotes the development of student's interpersonal skills, which may be related to the characteristics of millennials discussed earlier and their strive for independence. Question 6 relates to Employability skill #6 'Locate, select, organize, and document information using appropriate technology and information systems' part of the information management skill set where students expect the abundant existence and accessibility to computers. This is required to apply their knowledge and practice newly acquired concepts. This is related to question 9, which states that technology improves student learning of critical concepts and ideas. This is similar to Employability skill #7 'Analyze, evaluate, and apply relevant information from a variety of sources.' In a dynamic, global environment students expect immediate access to technology. It is worth noting that there is a gap between the actual and desired situation. Although Ontario Colleges have an abundance of computer labs and advanced infrastructure, this competitive advantage is currently under depletion with the increase in class sizes and cuts to education funding, causing a strain on technological resources. This sometimes causes students to access their learning management systems, simulations and assignments through their smart phones, which although convenient, may not be conducive to the learning process.

Finally, when asked if technology will increase the amount of stress and anxiety students experience 90% (101 students) of participants indicated that they strongly / slightly agree, while only 10% (11 students) indicated that they strongly / slightly disagree. Question 7 is related to teacher training and their confidence and practice with the technology used in class (questions 1, 2 & 3 of set 2). *It is worth noting that the answers showed a similar distribution, with 100% of participants indicating that they either strongly / slightly agree with the statement*.

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CONCLUSION

Industry 4.0 is more than the technology it is bringing. As workforce is a critical element in digital transformation, the skills and qualifications of the human capital will become increasingly eminent. There are many skills and qualifications that will be needed in the era of Industry 4.0, but as stated in the literature review, digital literacy and digital dexterity will be essential and primary skills for the future workforce. Digital literacy is defined as "capabilities ranging from technical skills (such as those used in coding), to digital citizenship, to the ability to identify fake news", digital dexterity is defined as 'the ability and desire to use existing and emerging technologies for better business outcomes'.

Today's students' digital literacy and dexterity will be the main mechanism that will empower organizations to utilize upcoming critical digital developments. The demand for these skills and qualifications will undeniably be higher when compared to the present. This will result in the need for changing and adapting the existing curricula and the tools used in the existing educational system which will equip students with the essential employability skills required to remain competitive in industry 4.0.

In the research, a detailed questionnaire was prepared as a pilot study to comprehend students' views on the use of technology in classrooms and its impact on their learning experience and engagement. Knowledge of their views allowed the authors to draw inferences as to the skills and competencies of future students and whether they would match industry 4.0. Parts of the questionnaire used were extracted from the 'Technology Implementation Questionnaire'. Research results show that that there is a gap between the existing situation in the Ontario College in which the research was conducted and the desired situation where employability skills are adhered to and technology savvy graduates are populating the workforce.

Although the research findings are all preliminary and need to be retested within a larger sample, including several Ontario colleges in multiple locations, it seems that the results do confirm the original hypothesis. 'There seems to be a gap between the desired employability skills and the current situation within Ontario Colleges'. This may be due to a variety of factors including large class sizes, the inability to train teachers on the use of new technology given large administrative and course loads and teacher's age.

Age does not seem to be a variable impacting the adoption of technology by students. Yet, gender does have a bearing on the results of this research. Preliminary results show that females are more traditional learners and believe in the traditional brick and mortar learning institution, including the role of teachers in disseminating knowledge. Given the fact that not all employability skills are being achieved, it seems that students are not ready for industry 4.0. For students to be better prepared for the future workplace and the use of technology, the higher educational sector needs to be streamlined with a more rigorous approach towards teacher training, student accessibility to technology, reducing class sizes and dedicating a hefty budget to technological infrastructure and tools. If this is done, the employability skills will fall into place, leading to a technology savvy workforce.

The Canadian Ministry of Higher Education seems dedicated to the use of employability skills as a determinant for graduates' workplace readiness. Although this is unique to Canada, other countries, including the USA and Germany, presented in this chapter as comparable examples, have not identified the skill set / competencies that graduates need to possess. This raises an important question… Are employability skills the correct means to gauge workplace readiness? Should they be substituted by another indicator / set of indicators? The researchers feel that both employers and teachers are important stakeholders in this decision. They should have an opinion as to their employees' performance and readiness for further challenges / promotions in the workplace. Hence, based on the above research and our recommendations

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for the future, employers should be a definite part of the cycle. Since we have determined that students *think* they are ready for industry 4.0, but colleges are failing in their preparation, employers need to be added as a moderating factor / variable.

Since colleges are focused on providing applied knowledge to their students, it is important to engage employers who can shed additional light on required skills that they see necessary from work within their specific industries / fields. This may include knowledge of specific ERP systems, project management systems or simple tools. This will entail hiring teachers with this knowledge, updating and revamping the existing curricula to include these subject matters and other technology / non-technology skills, and making sure that the course learning outcomes are updated and well-written to match all of the above. Again, this is all linked to teacher's readiness to do this extra work with the existing workload, increasing class sizes and decreased funding dedicated to education and colleges. This shows that this is a vicious cycle in which all the variables are interrelated. With the rise of globalization and graduates aspiring to be mobile, this model has been adopted in some countries with a smaller workforce like the Nordic block. Yet, in Canada this is not the case. This is where this research proves essential since it raises multiple questions that need to be answered and tries to bridge a gap in the theoretical data available about the education industry in Canada – Ontario.

FUTURE RESEARCH

The research findings stated above are all preliminary and need to be retested within a larger sample to ensure generalizability, perhaps as a joint initiative within Ontario colleges in multiple locations. It would be considered as a multi-site project, in which data from business schools in Ontario Colleges would be collected. As a further step, one could also look into the use of the questionnaire in other schools as well including early childhood education, engineering, aviation, etc… This would provide a wealth of data, which could be used to determine with accuracy the readiness of Ontario College students to industry 4.0 and whether or not they possess the necessary employability skills. As a further initiative, Colleges could contact their graduate Alumni who can answer questions regarding their experience with industry 4.0 and if they feel they had been prepared in colleges enough for the workplace. Not only would this require a different questionnaire, but also a large-scale research which involves multiple researchers and commitment from Ontario Colleges to answer the hypothesis at hand.

On another level, if the research results from Ontario were then compared to other provinces across Canada, one could end up with statistics from across the country. These findings could then be submitted to the government as recommendations for the Ministry of Higher Education and Training. If Canada wants to be competitive in the field of Higher Education to attract foreign students to its higher education institutions, it must ensure the employability of its graduates compared to other developed countries, including the USA and Germany that have found evidence to support the importance of technology skills as a prerequisite to workplace readiness. Hence, investing heavily in this area, not only in higher education, but also since school years.

Finally, for this research to be truly effective, a comparison with other cultures might add an additional lens to the research. It would provide the researchers with a wealth of data to compare if the issues outlined above are universal or unique to the Canadian higher education sector in specific. Moreover, it would answer questions like 'does culture impact the propensity to use technology', 'does culture value

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the use of technology in the higher education system'. These are imperative questions which should be answered to comprehend the readiness of Generation Y worldwide to industry 4.0 in light of globalization.

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KEY TERMS AND DEFINITIONS

Digital Dexterity: Is a student's/employee's ability and desire to use existing and emerging technologies for better business outcomes.

Digital Literacy: Is a student's/employee's ability to find, analyze, and present clear and concise information, either through writing or the use of technology tools.

Essential Employability Skills (EES): These are skills compiled by the Canadian Ministry of Higher Education in Ontario. They include a list of 11 skills divided into 6 categories, which include numeracy, communication, critical thinking and problem solving, information management, interpersonal and personal skills.

Future Skills: Skills that Generation Y are expected to possess to ensure their employability. These constitute/are synonymous with essential employability skills.

Future Workforce: Generation Y millennials that are expected to hit the workforce within the next decade. They are the technology-savvy graduates that will cause the industrial revolution 4.0.

Higher Education: Refers to post-secondary education. This is education following high school of grade 12 in several countries.

Learning Management System (LMS): A technology tool launched within the last decade where students and teachers can communicate. The system is a logistical hub, allowing teachers to share notes, slides, and assignments, create tests, forums, and discussions with students.

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Technology in Education: The ability to use technology tools in education. These include, but are not limited to, Microsoft Office, simulation, ERP systems, wikis, discussion boards, forums, and learning management systems.

VARK Learning Model: Research that postulates that students learn/absorb information in different ways including visual, auditory (listening), read-write, and kinesthetic (learning by doing).

Workplace Competencies: Key skills and attributes required to secure a position in the workplace. These may include technology skills, critical thinking, and analytical skills.

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