Chapter 2
Past Achievements and Future Promises of Digital Transformation: A Literature Review

Mohamed Alloghani, Christopher Thron, and Saad Subair

2.1 Introduction

Digital technology has profoundly impacted nearly every aspect of society. In business, it has demonstrated extraordinary capacity for restructuring of operations, processes, and market characteristics and in the process has fundamentally changed industries and disrupting markets. Today, the focus of implementing technology in many settings has moved beyond improvement of efficiency of internal operations to include improvement of interactions with clients and improvement or complete revolution of services. In order to describe these new possibilities, a new terminology has sprung up, including such popular buzz words as 'Internet of Things', 'Industry 4.0', and 'Big Data'. One new term that is becoming increasingly pervasive in industry (and, more recently, among researchers) is 'digital transformation'. As described earlier in the abstract, digital transformation refers to the idea of extensive restructuring of operations in organizations, business agencies, and other entities to incorporate technological innovations that completely reshape the approach to the processes. As depicted from Fig. 2.1, the digital transformation integrates

M. Alloghani (✉)
Computing and Mathematical Sciences, Liverpool John Moores University, Liverpool, UK

The UAE Artificial Intelligence Office, Prime Minister's Office at the Ministry of Cabinet Affairs and the Future, Dubai, UAE

C. Thron
Department of Science and Mathematics, Texas A&M University-Central Texas, Killeen, TX, USA
e-mail: thron@tamuct.edu

S. Subair
College of Computer Studies, International University of Africa, Khartoum, Sudan
e-mail: ssubair@iua.edu.sd

M. Alloghani et al. (eds.), *Artificial Intelligence for Data Science in Theory and Practice*, Studies in Computational Intelligence 1006,
https://doi.org/10.1007/978-3-030-92245-0_2

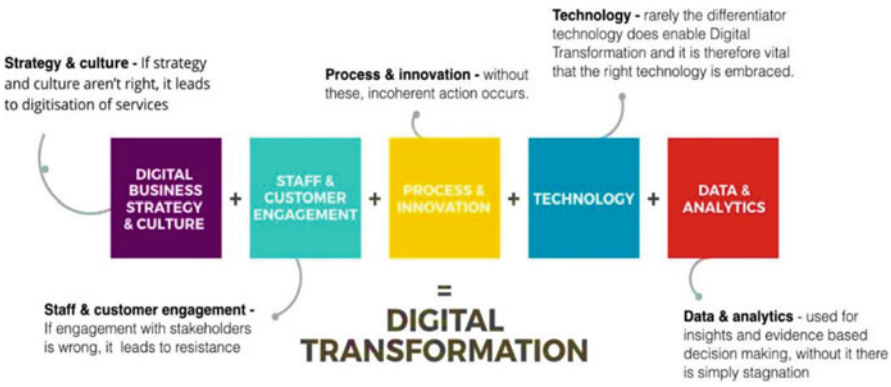

Fig. 2.1 Key blocks of digital transformation (Ionology, 2020)

digital technology into all aspects of an entity's operations and delivering value to customers. It's also a cultural shift that necessitates organizations challenging the status quo, experimenting, and becoming agile. The design, business model, and operations are all included in the three-stage process of digital transformation.

This concept is still relatively new, and the literature on its description, adoption, and impact is lacking in many aspects. This literature review aims to address these shortcomings by identifying scholarly research and information that currently exists regarding the conceptualization, adoption, impacts, and future trends of digital transformation.

2.2 Materials and Methods

To map out as much of the existing information on the topic as possible, a systematic review of the literature was conducted. This approach involved a strategic search and identification of resources that addressed various parts of the topic, followed by a careful review of the contents of the published resources and the ideas or arguments presented in each. The data collection section of a systematic review typically entails deliberate steps and procedures that are described and performed with sufficient clarity as to allow their replication. As a guide for searching for resources for this review, the author applied selected PRISMA, a framework developed to guide the systematic identification and acceptance or rejection of scholarly articles from databases and other sources.

2.2.1 Search Strategy

The author conducted a search for literature on the topic in two of the largest databases of peer-reviewed articles, abstracts, and other resources in several fields: Web of Science and Scopus. The search strategy used combinations of carefully selected keywords to retrieve published works related to the topic of interest. The specific keywords utilized were: 'digital transformation', 'IT-driven transformation', 'IT-enabled business transformation', 'digitization', and 'digital business strategy'. To increase chances of retrieving a larger number of relevant publications, various combinations of these search terms were applied alternatively using Boolean operators 'AND' and 'OR'. Since the literature review was intended to capture as much of the relevant information that already exists on the topic as possible, there was no specification on the date of publication of the resources to be retrieved. However, the type of sources was specified as journal articles and conference proceedings only, a limitation that was applied to exclude sources that may be too lengthy to allow sufficient review or contain non-scholarly information and poorly researched or non-peer-reviewed data. The search terms and specifications used were similar for both databases. Although the database search constituted the primary source of articles for the review, the author decided to review the bibliography sections of articles that meet inclusion criteria for possibly relevant sources. After running the keywords in isolation and as Boolean combinations and returning results, the author performed a manual scan of all the titles and abstracts to determine relevance of each source, which was dictated by the inclusion and exclusion criteria.

2.2.2 Inclusion and Exclusion Criteria

Although the author was cautious about excluding useful publications or ending up with too few resources for the review, certain basic criteria had to be met for a source to be included. To avoid the potential for misinformation and inaccurate reporting, all sources that would be included had to be written in English language. Additionally, the abstract, titles, or keywords of the publications that would be selected should mention at least one of the keywords used to obtain the sources from the databases. However, some resources only used these keywords as entry terms in the introductory or abstract section before proceeding to discuss other unrelated issues. Such articles were rejected.

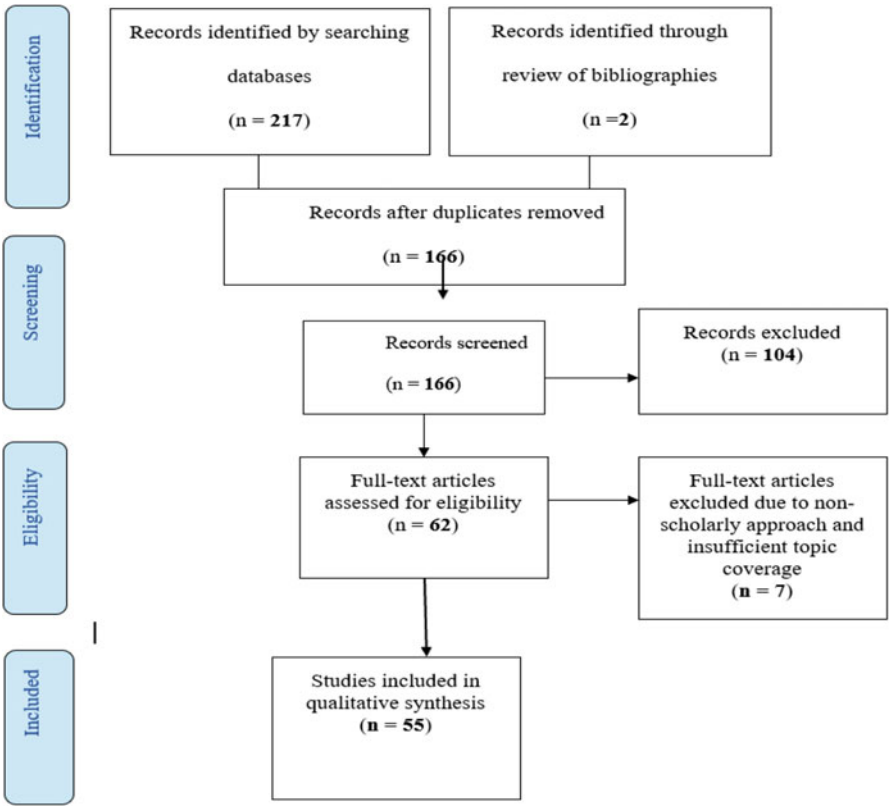

Fig. 2.2 PRISMA flow diagram showing number of records identified, screened, and included in the literature review

2.3 Results and Discussion

As shown in Fig. 2.2, the initial search from the two databases returned a combined 217 articles from different journals and conference proceedings. Comparison of the two results lists revealed that 53 articles were duplicates and their exclusion left 164 articles. The screening of the titles and abstracts of the remaining articles resulted in the exclusion of 104 articles, most of which were written in French and German. Some 60 articles were then read in their entirety to determine their appropriateness for the review. Three of these sources presented discussions in formats and tones that were not consistent with scholarly research. A further four articles covered too little of digital transformation as the subject to enable meaningful contribution to the topic. Two relevant articles were found by analysing the bibliographies of the included sources. Eventually, 55 articles were included for the qualitative and quantitative analysis that formed part of the current review. The PRISMA flow diagram for the search process and results is shown in Fig. 2.2.

The sources selected for the final review discussed a large amount of information on a wide range of topics related to digital transformation. Additionally, the articles displayed a number of interesting characteristics that pointed to the nature of the topic under research. For instance, despite the lack of restriction on the date of publication during the search for information, the oldest resource included for the review was written in 2010 (Agarwal et al., 2010). The article, published in the Information Systems Research journal, presents one of the earliest reviews of existing literature on digital transformation. However, like many of the previous reviews of literature on the issue, the article's scope is restricted to a specific component of digital transformation—in this case, its adoption in the health sector of the United States (Agarwal et al., 2010). Another two articles were published 5 years later, both discussing the theoretical approaches to adoption of digital strategies in organization (Ganguly, 2015; Schuchman & Seufert, 2015). Remarkably, the bulk of the resources utilized for this review were published in 2018 (20, 36.4%) and 2020 (18, 32.7%), up from only nine sources (16.4%) published in 2017 (Table 2.1). This sharp increase in the number of academic articles released in the last 2 years suggests the emergence of important factors driving scholarly interest in the phenomenon of digital transformation.

The search for distinct drivers of such an influx of academic publications on the matter did not reveal specific causes, although a significant portion of the sources published in the 2 years were presented in conferences held in different countries in Europe during the same period.

Another interesting pattern that is apparent in the existing body of literature on digital transformation is the concentration of published articles in the European continent. As part of the quantitative analysis, the sources were categorized according to the country or region on which the discussion concentrates, which was often the same country where the article was published. While many of the sources clearly identified the scope of their research or discussion as a specific country, some addressed the issue of digital transformation from a general viewpoint, without making specific references or examples of local situations in any country. Still, others discussed the topic from the perspective of an entire continent rather than specific countries. Despite these challenges, the analysis enabled the identification of countries and regions with the highest number of publications on the topic. Fourteen of the sources (25.5%) were either published in or discussed the situation in Germany (Table 2.2). Most of the other articles were either associated with another country in Europe or addressed aspects of digital transformation in the European continent in general.

This concentration of published literature in the European continent has not been addressed in previous literature reviews. Although an explanation for the skew has not been formally sought, the difference in the distribution of resources on the topic could be explained in two ways. The first explanation could be that the keywords and search terms used corresponded to terminology most widely used in European countries. This situation is highly likely since 'digital transformation' and 'digitization' are terms coined in informal conversations and literature in many European countries, while in the United States and other countries in the American

Table 2.1 Distribution of sources over time

Year	Number of sources	Percentage	References
2010	1	1.8	Agarwal et al. (2010)
2015	2	3.6	Ganguly (2015), Schuchman and Seufert (2015)
2016	5	9	Stief et al. (2016), Hess et al. (2016), Majchrzak et al. (2016), Henriette et al. (2016), OECD (2016)
2017	9	16.4	Reddy and Reinartz (2017), Paritala et al. (2017), von Leipzig et al. (2017), Omar et al. (2017), Parviainen et al. (2017), Ndemo and Weiss (2017), Schallmo et al. (2017), Resego et al. (2017), European Union (2017)
2018	20	36.4	Al-Ruithe et al. (2018), Goerzig and Bauernhansl (2018), Zahara and Petreanu (2018), Issa et al. (2018), Osmundsen et al. (2018), Afonasova (2018), Rachinger et al. (2018), Hess and Constantiou (2018), Ibarra et al. (2018), Kotarba (2018), Skog et al. (2018), Limani et al. (2018), Benjamin and Potts (2018), Nadeem et al. (2018), Sow (2018), Chanias et al. (2018), Nwaiwu (2018), Kirsten et al. (2018), Tewes et al. (2018), Moreira et al. (2018)
2020	18	32.7	Oertwig et al. (2019), Genzorova et al. (2019), Mergel et al. (2019), Vogelsang et al. (2019), Dugstad et al. (2019), Zulkarnain et al. (2019), Mhlungu et al. (2019), Gbadegeshin (2019), Savastano et al. (2019), Dufva and Dufva (2019), Cortellazzo et al. (2019), Holth and Boe (2019), Promsri (2019), Kaplan and Tewes (2019), Verina and Titko (2019), Ivancic et al. (2019), Pelletier and Cloutier (2019), Skog (2019)

continent, the term 'Internet industry' has often been applied as an equivalent to 'Industry 4.0', another connotation of the widespread infiltration of technological alterations of operations across industries (Dufva & Dufva, 2019). Therefore, the large number of studies in European continent could reflect a bias in the search strategy towards this region. Alternatively, the skewness is a representation of the industries and sectors most affected by digital transformation. For instance, the sources from European countries addressed the incorporation of digital innovations in manufacturing, engineering, banking and commerce, retail, government services, and other sectors, while US-based articles were largely restricted to the adoption of digital technologies in the health sector and the role of leadership in the incorporation of technological strategies. The review of the selected scholarly resources revealed that digital transformation is a wide concept with several components and dimensions.

The bulk of studies now seem interested in the dynamics of adoption of digital transformation in organizations, a tendency that reflects the interests of practitioners

Table 2.2 Classification of sources by country/region

Country/region	No. of sources	Percentage	References
Germany	14	25.5	Oertwig et al. (2019), Goerzig and Bauernhansl (2018), von Leipzig et al. (2017), Vogelsang et al. (2019), Stief et al. (2016), Reddy and Reinartz (2017), Gbadegeshin (2019), Hess and Constantiou (2018), Savastano et al. (2019), Schallmo et al. (2017), Kaplan and Tewes (2019), Chanias et al. (2018), Kirsten et al. (2018), Tewes et al. (2018)
United Kingdom	4	7.3	Omar et al. (2017), Issa et al. (2018), Ganguly (2015), Benjamin and Potts (2018)
United States	7	12.7	Dugstad et al. (2019), Agarwal et al. (2010), Zulkarnain et al. (2019), Hess et al. (2016), Rachinger et al. (2018), Majchrzak et al. (2016), Sow (2018)
Canada	2	3.6	Ivancic et al. (2019), Pelletier and Cloutier (2019)
Europe	3	5.4	Mergel et al. (2019), OECD (2016), European Union (2017)
Romania	2	3.6	Zahara and Petreanu (2018), Ibarra et al. (2018)
Finland	2	3.6	Parviainen et al. (2017), Dufva and Dufva (2019)
Switzerland	1	1.8	Schuchman and Seufert (2015)
France	1	1.8	Henriette et al. (2016)
Greece	1	1.8	Osmundsen et al. (2018)
Portugal	1	1.8	Moreira et al. (2018)
Russia	1	1.8	Afonasova (2018)
South Africa	1	1.8	Mhlungu et al. (2019)
Kenya	1	1.8	Ndemo and Weiss (2017)
Poland	1	1.8	Kotarba (2018)
Norway	1	1.8	Holth and Boe (2019)
Italy	1	1.8	Cortellazzo et al. (2019)
Sweden	2	3.6	Skog et al. (2018), Skog (2019)
Australia	2	3.6	Paritala et al. (2017), Nadeem et al. (2018)
Kosovo	1	1.8	Limani et al. (2018)
Thailand	1	1.8	Promsri (2019)
Lithuania	1	1.8	Verina and Titko (2019)
Czech Republic	1	1.8	Nwaiwu (2018)
Slovenia	1	1.8	Resego et al. (2017)
Saudi Arabia	1	1.8	Al-Ruithe et al. (2018)
Slovak Republic	1	1.8	Genzorova et al. (2019)

Table 2.3 Classification of sources by research areas

Research area	Number of sources	Percentage	References
Definition and conceptualization	8	14.5	Mergel et al. (2019), Hess et al. (2016), Skog et al. (2018), Schallmo et al. (2017), Verina and Titko (2019), Nwaiwu (2018), Resego et al. (2017), European Union (2017)
Adoption of digital transformation	34	61.8	Oertwig et al. (2019), Al-Ruithe et al. (2018), Genzorova et al. (2019), Goerzig and Bauernhansl (2018), von Leipzig et al. (2017), Zahara and Petreanu (2018), Omar et al. (2017), Issa et al. (2018), Osmundsen et al. (2018), Vogelsang et al. (2019), Dugstad et al. (2019), Agarwal et al. (2010), Stief et al. (2016), Zulkarnain et al. (2019), Afonasova (2018), Mhlungu et al. (2019), Hess and Constantiou (2018), Parviainen et al. (2017), Ndemo and Weiss (2017), Majchrzak et al. (2016), Holth and Boe (2019), Limani et al. (2018), Henriette et al. (2016), Benjamin and Potts (2018), Nadeem et al. (2018), Sow (2018), Promsri (2019), Schuchman and Seufert (2015), Ivancic et al. (2019), Chanias et al. (2018), Kirsten et al. (2018), Pelletier and Cloutier (2019), Skog (2019), OECD (2016)
Impact of digital transformation	8	14.5	Rachinger et al. (2018), Reddy and Reinartz (2017), Gbadegeshin (2019), Ibarra et al. (2018), Savastano et al. (2019), Kotarba (2018), Cortellazzo et al. (2019), Moreira et al. (2018)
Future trends in digital transformation	5	9.1	Paritala et al. (2017), Dufva and Dufva (2019), Ganguly (2015), Kaplan and Tewes (2019), Tewes et al. (2018)

whose focus is on implementing digital solutions rather than studying what they mean. Altogether, the scholarly literature may be categorized into four general areas: definition and conceptualization of digital transformation (14.5% of sources), adoption of digital solutions (including incorporation strategies, challenges, and success factors) (61.8% of sources), impact of digital transformation (on different areas of organizational operation such as business models) (14.5% of sources), and future trends in digital transformation (9.1% of sources). Table 2.3 shows the distribution of articles between these research areas.

One of the recurrent themes in the research on the adoption of digital strategies is the need to view this phenomenon as a full-scale organizational change, as opposed to treating it as a technological innovation that needs to be incorporated into

the company's procedures. Therefore, researchers recommend the mobilization of the organization's entire resources, especially the extensive involvement of human resources in digitization efforts. Other variables identified as critical determinants of success in transformation operations include leadership, collaboration with suppliers and customers, adoption of an agile approach, and organization culture change.

The discussions on adoption of digital processes are dominated by theoretical frameworks that provide guidelines on appropriate digitization strategies. Articles that fall into the 'adoption of digital transformation' category also outline important challenges to the effective incorporation of technological innovations in organizational operations, with the most commonly cited barriers including cultural inertia, lack of strategic management, inadequate human resource involvement, and lack of defined digital strategies (Zahara & Petreanu, 2018; Afonasova, 2018; Parviainen et al., 2017). Among these theoretical models, the most emphasized approaches are resource-based—which encourage organizations to accumulate and mobilize resources towards the digital change and value proposition—which emphasize the need to utilize digital processes to generate value for the client. The latter theoretical model is particularly common among organizations in the manufacturing sector, where researchers have repeatedly acknowledged the preference by clients of customization of products as the most important measures of value. Many studies that addressed the impact of digital transformation on the business models of the companies that are affected found that value proposition is the most convenient approach to utilize the change for income generation (Genzorova et al., 2019; Rachinger et al., 2018; Ibarra et al., 2018; Tewes et al., 2018).

The most recent of these drivers include Internet of Things, artificial intelligence (AI), 3D printing, Big Data, drones and robotics, and augmented and virtual reality (Paritala et al., 2017; Dufva & Dufva, 2019; Ivancic et al., 2019; European Union, 2017). Artificial intelligence (AI) is considered one of the most disruptive emerging technologies, although its implementation and development is still at its infant stages (Dufva & Dufva, 2019; Verina & Titko, 2019). Presently, the most significant impact of AI is in machine learning, where application of statistical algorithms and patterns allows users to automate a remarkably large number of tasks and create self-organizing systems (Dufva & Dufva, 2019; Schallmo et al., 2017). This functionality is particularly useful in manufacturing industries, where automation of repetitive tasks has massive effects on the cost of production and value creation. The automation afforded by classical AI technologies also reduces the rates of errors in processes and increases operation speed.

Articles that focus on the definition and conceptualization of digital transformation uniformly point out that this aspect of the phenomenon has been largely neglected. Despite the widespread discussion and publication of items on the adoption strategies, driving forces, success factors, and challenges facing the incorporation of digital processes in organizations, little is still known about what digital transformation itself means. A commonly expressed concern is that there are too many definitions of digital transformation, many of which are vague and do not reflect the full extent of components encompassed by the process. Conceptual

frameworks that attempt to describe what digital transformation is generally break it down into component that correspond to the digital technologies being adopted and the user experience (Henriette et al., 2016). An important third dimension is organizational human resources, which is increasingly being emphasized as a critical determinant of success in the transformation process.

Discussions of the future trends in digital transformation are not abundant. Among the articles that address this question, the focus is on appropriate adoption strategies for the upcoming technologies, as well as the expected impact of the changes on various areas of organizational operations. Researchers tend to agree that the future will bring along increased adoption of technology in enterprises that already embrace innovations and a forceful permeation into firms that currently resist the change, which will be forced to adopt the strategy in order to survive in the fiercely competitive business environment that will result.

2.4 Conclusions

The widespread influence of technological innovations in business, education, public service, and other areas of society has sparked a large amount of interest among practitioners in these sectors. Additionally, this rising significance of technology, particularly its capacity to radically change approaches to service delivery, organizational operations, and other functional aspects of businesses means that digital transformation has the potential to reshape the way business is conducted, which has implications for both enterprises and their clients. Consequently, there have been increased attempts to understand various theoretical concepts related to the widespread adoption of technology in operations, including digital transformation, digitization, Internet of Things, and Big Data. Although a considerable amount of literature already exists on digital transformation, a systematic review of this content reveals that most of it has been published in the last 2 years. This trend suggests that the topic is still new and has recently generated a high amount of both academic and practitioner interest. Despite the now large amount of literature on digital transformation, the term still remains to be adequately conceptualized, and definitions of the concept are many and often vague. Future research in this area should focus on consolidating the conceptualization efforts to develop a clear definition and a single, comprehensive theoretical framework for approaching digital framework.

References

Afonasova, M. (2018). Digital transformation of the entrepreneurship: Challenges and prospects. *Journal of Entrepreneurship Education, 21*(25), 1–7.

Agarwal, R., Gao, G., DesRoches, C., & Jha, A. (2010). The digital transformation of healthcare: Current status and the road ahead. *Information Systems Research, 21*(4), 796–809.

Al-Ruithe, M., Benkhelifa, E., & Hameed, K. (2018). Key issues for embracing the cloud computing to adopt a digital transformation: A study of Saudi public sector. *Procedia Computer Science, 130*, 1037–1043.

Benjamin, K., & Potts, W. (2018). Digital transformation in government: Lessons for digital health? *Digital Health, 3*(1), 1–5.

Chanias, S., Myers, M., & Hess, T. (2018). Digital transformation strategy making in pre-digital organizations: The case of a financial services provider. *Journal of Strategic Information Systems*, 1–17. https://doi.org/10.1016/j/jsis.2018.11.003

Cortellazzo, L., Bruni, E., & Zampieri, R. (2019). The role of leadership in a digitized world: A review. *Frontiers in Psychology, 10*(1938), 2–21.

Dufva, T., & Dufva, M. (2019). Grasping the future of the digital society. *Futures, 107*(2019), 17–28.

Dugstad, J., Eide, T., Nilsen, E. R., & Eide, H. (2019). Towards successful digital transformation through co-creation: A longitudinal study of a four-year implementation of digital monitoring technology in residential care for persons with dementia. *BMC Health Services Research, 19*(2019), 1–17.

European Union. (2017). *A concept paper on digitization, employability, and inclusiveness: The role of Europe*. DG Communications Networks, Content & Technology.

Ganguly, A. (2015). Optimization of IT and digital transformation: Strategic imperative for creating a new value delivery mechanism and a sustainable future in organization! *European Journal of Business and Innovation Research, 3*(2), 1–13.

Gbadegeshin, S. (2019). The effect of digitalization on the commercialization process of high-technology companies in the life sciences industry. *Technology Innovation Management Review, 9*(1), 49–65.

Genzorova, T., Corejova, T., & Stalmasekova, N. (2019). How digital transformation can influence business model, Case study for transport industry. *Transportation Research Procedia, 40*(2019), 1053–1058.

Goerzig, D., & Bauernhansl, T. (2018). Enterprise architectures for the digital transformation in small and medium-sized enterprises. *Procedia CIRP, 67*(2018), 540–545.

Henriette, E., Feki, M., & Boughzala, I. (2016). Digital transformation challenges. In *Mediterranean Conference on Information Sciences 2016 Proceedings*, Association for Information Systems.

Hess, T., & Constantiou, I. (2018). Introduction to the special issue on "Digitalization and the Media Industry". *Electronic Markets, 28*(2018), 77–78.

Hess, T., Matt, C., Benlian, A., & Wiesbock, F. (2016). Options for formulating a digital transformation strategy. *MIS Quartely Executive, 15*(2), 123–140.

Holth, T., & Boe, O. (2019). Lost in Transition: The dissemination of digitization and the challenges of leading in the military educational organization. *Frontiers in Psychology, 10*(2049), 1–25.

Ibarra, D., Ganzarain, J., & Igartua, J. (2018). Business model innovation through industry 4.0: A review. *Procedia Manufacturing, 22*(2018), 4–10.

Ionology. (2020). Digital transformation framework. [Online]. Available: https://www.dxlatest.com/

Issa, A., Hatiboglu, B., Bildstein, A., & Bauernshansl, T. (2018). Industrie 4.0 roadmap: Framework for digital transformation based on the concepts of capability maturity and alignment. *Procedia CIRP, 72*(2018), 973–978.

Ivancic, L., Vuksic, V., & Spremic, M. (2019). Mastering the digital transformation process: Business practices and lessons learned. *Technology Innovation Management Review, 9*(2), 36–52.

Kaplan, C., & Tewes, S. (2019). Redesigning business model strategy: The digital future of retailing in Europe. *Journal of International Business Research and Marketing, 4*(3), 1–7.

Kirsten, L., Vogelsang, K., Packmohr, S., & Hoppe, U. (2018). Towards a framework for digital transformation success in manufacturing. In *Proceedings of the Twenty-Sixth European Conference on Information Systems (ECIS2018)*, Portsmouth.

Kotarba, M. (2018). Digital transformation of business models. *Foundations of Management, 10*(2018), 123–143.

Limani, Y., Stapleton, L., & Groumpos, P. (2018). The challenges of digital transformation in post-conflict transition regions: Digital technology adoption in Kosovo. *International Federation of Automatic Control, 51-30*, 186–191.

Majchrzak, A., Markus, M., & Wareham, J. (2016). Designing for digital transformation: Lessons for information systems research from the study of ICT and societal challenge. *MIS Quarterly, 40*(2), 267–277.

Mergel, I., Edelmann, N., & Haug, N. (2019). Defining digital transformation: Results from expert interviews. *Government Information Quarterly*, 1–6. https://doi.org/10.1016/j.giq.2019.06.002

Mhlungu, N., Chen, J., & Alkema, P. (2019). The underlying factors of a successful organizational digital transformation. *South African Journal of Information Management, 21*(1), 1–10.

Moreira, F., Ferreira, M., & Seruca, I. (2018). Enterprise 4.0 – the emerging digital transformed enterprise? *Procedia Computer Science, 138*(2018), 525–532.

Nadeem, A., Abedin, B., Cerpa, N., & Chew, E. (2018). Digital transformation & digital business strategy in electronic commerce - the role of organizational capabilities. *Journal of Theoretical and Applied Electronic Commerce Research, 13*(2), 1–8.

Ndemo, B., & Weiss, T. (2017). Making sense of Africa's emerging digital transformation and its many futures. *Africa Journal of Management, 3*(4), 328–347.

Nwaiwu, F. (2018). Review and comparison of conceptual frameworks on digital business transformation. *Journal of Competitiveness, 10*(3), 86–100.

OECD. (2016). *Digital government strategies for transforming public services in the welfare areas*. OECD Comparative Study, OECD.

Oertwig, N., Gering, P., Knothe, T., & Rimmelspacher, S. O. (2019). User-centric process management system for digital transformation of production. *Procedia Manufacturing, 33*(2019), 446–453.

Omar, A., Weerakkody, V., & Sivaraja, U. (2017). Digitally enabled service transformation in UK public sector: A case analysis of universal credit. *International Journal of Information Management, 37*(4), 350–356.

Osmundsen, K., Iden, J., & Bygstad, B. (2018). Digital transformation: Drivers, success factors, and implications. In *Proceedings of the 12th Mediterranean Conference on Information Systems (MCIS)*, Corfu.

Paritala, P., Manchikatla, S., & Yarlagada, P. (2017). Digital manufacturing- applications past, current, and future trends. *Procedia Engineering, 174*, 982–991.

Parviainen, P., Kaariainen, J., Tihinen, M., & Teppola, S. (2017). Tackling the digitalization challenge: How to benefit from digitalization in practice. *International Journal of Information Systems and Project Management, 5*(1), 63–77.

Pelletier, C., & Cloutier, L. (2019). Challenges of digital transformation in SMEs: Exploration of IT-related perceptions in a service ecosystem. In *Proceedings of the 52nd Hawaii International Conference on System Sciences*, Hawaii.

Promsri, C. (2019). Developing model of digital leadership for a successful digital transformation. *International Journal of Business Management, 2*(8), 1–8.

Rachinger, M., Rauter, R., Muller, C., Vorraber, W., & Schirgi, E. (2018). Digitalization and its influence on business model innovation. *Journal of Manufacturing Technology Management*, 1–18. https://doi.org/10.1108/JMTM-01-2018-0020

Reddy, S., & Reinartz, W. (2017). Digital transformation and value creation: Sea change ahead. *Value in the Digital Era, 9*(1), 10.

Resego, M., Audrey, G., & Philip, O. (2017). Conceptualizing digital transformation in business organizations: A systematic review of literature. In *Proceedings of the 30th Bled eConference*, Slovenia, Bled.

Savastano, M., Amendola, C., Bellini, F., & D'Ascenzo, F. (2019). Contextual impacts on industrial processes brought by the digital transformation of manufacturing: A systematic review. *Sustainability, 11*(891), 1–38.

Schallmo, D., Williams, C., & Boardman, L. (2017). Digital transformation of business models — best practice, enablers, and roadmap. *International Journal of Innovation Management, 21*(8), 1–17.

Schuchman, D., & Seufert, S. (2015). Corporate learning in times of digital transformation: A conceptual framework and service portfolio for the learning function in banking organizations. *iJAC, 8*(1), 31–40.

Skog, D. (2019). *The dynamics of digital transformation the role of digital innovation, ecosystems and logics in fundamental organizational change*. Umea University.

Skog, D., Wimelius, H., & Sandberg, J. (2018). Digital disruption. *Business Information Systems Engineering, 605*(5), 431–437.

Sow, D. (2018). Impact of leadership on digital transformation. *Business and Economic Research, 8*(3), 140–146.

Stief, S., Theresa, A., & Voeth, M. (2016). Transform to succeed: An empirical analysis of digital transformation in firms. *World Academy of Science Engineering and Technology, 10*(6), 1833–1844.

Tewes, S., Tewes, C., & Jager, C. (2018). The 9×9 of future business models. *International Journal of Innovation and Economic Development, 4*(5), 39–48.

Verina, N., & Titko, J. (2019). Digital transformation: Conceptual framework. In *Proceedings of the International Scientific Conference on Contemporary Issues In Business, Management And Economics Engineering, Vilnius, Lithuania*. VGTU Press.

Vogelsang, K., Liere-Netheler, K., Packmohr, S., & Hoppe, U. (2019). Success factors for fostering a digital transformation in manufacturing companies. *Journal of Enterprise Transformation*, 1–22. https://doi.org/10.1080/19488289.2019.1578839

von Leipzig, T., Gamp, M., Manz, D., et al. (2017). Initialising customer-orientated digital transformation in enterprises. *Procedia Manufacturing, 8*(2017), 517–524.

Zahara, S. E., & Petreanu, C. V. (2018). Challenges in airport digital transformation. *Transportation Research Procedia, 35*(2018), 90–99.

Zulkarnain, N., Hidayanto, A., & Prabowo, H. (2019). The critical success factors for big data adoption in government. *International Journal of Mechanical Engineering and Technology, 10*(3), 864–875.