

A Systematic literature review of Digital Transformation

Mohamed-Iliasse Mahraz¹, Loubna Benabbou², Abdelaziz Berrado¹,

**1-Département Génie industriel, Ecole Mohammadia d'Ingénieurs,
Mohammed V University of Rabat, Morocco**

**2-Département Sciences de la Gestion, Université du Québec à
Rimouski (UQAR) Campus de Lévis, Québec, Canada**

m.mahraz@hotmail.fr , Loubna_benabbou@uqar.ca , berrado@emi.ac.ma

Abstract :

The digital transformation of society is not a recent topic. Technology is everywhere, via connected watches, in our pockets with our smartphones and at home with connected objects. It connects us to a world that makes our lives easier and creates interconnections between people and businesses. This new world created by us and for us uses our data to facilitate our daily lives and deepen our links with consumption. The emergence of new tools based on Artificial Intelligence, and some technological transformations based on Big Data, as well as the development of the use of Internet of Objects, push for a profound change impacting all the business processes of the enterprise. A large number of studies have been conducted in the field have tried to give a comprehensive portrait to understand some aspects of digital transformation better. The purpose of this study is to form a basis for future studies which may help future studies to understand the digital transformation and its characteristics better and also to build a framework of digital transformation. The purpose of this study is to give a comprehensive state of the art of digital transformation through a review of 164 that can serve as a basis for a roadmap for digital transformation.

Introduction :

Nowadays, Companies are changing due to new information and communication technologies, but few have understood how to reap the benefits of this phenomenon. The digital transformation (DT) is essential for all companies, regardless of their size and sector of activity. Beyond the dematerialization of work processes, this approach allows companies to optimize their operations, and to gain in performance, efficiency, and competitiveness through the adoption of a new management mode, new tools, new methods of work but also new reflections and organizations.

The DT has become a significant topic of concern and a strategic issue for all organizations. It offers new opportunities for companies, beyond their traditional activities, by accelerating their growth and creating sustainable competitive advantages and security of operations.

The DT increases the profitability of the company by simplifying processes and interactions within the company. The technologies linked to the DT such as Big Data, Artificial Intelligence, Cloud Computing, Social networks and the Internet of Things, offer new uses based on innovation and focused on the needs of the consumer. The use of these tools has become a vital issue for companies of all types of activities, sizes, and nationalities. However, the implementation of new technologies is not sufficient to make the digital enterprise, it is a broader phenomenon, which supposes not only the use of new digital tools but also the changes of the critical business elements, including strategy, business model, business processes, organizational structures and organizational culture (V. Arribas and J. A. Alfaro, 2018). It is a way of culture to appropriate, not only within companies but also in everyday life. Strategy, as well as changes to an organization, including its structure, processes, and culture, are required to yield the capability to generate new paths for value creation.

In recent years, a large number of studies tried to give a definition and also a solution to manage the digital transformation successfully. Despite this significant number of studies that have been conducted, a little attempt has been made to systematically translate these findings into a comprehensive review. However, there is still a lack of frameworks and guidelines for companies on how to navigate such radical changes (B. Bygstad, H.-P. Aanby, and J. Id, 2017) (S. Chanas and T. Hess, 2016). In this paper, we intend to provide a research agenda on digital transformation with new perspectives, based on systematic literature review method that allows us to explore all aspects of the existing literature and empirical evidence. For that, we tracked the recent academic and trade literature to find research in this field. We will give more insight into the literature and so on the research methodology in the next section.

The complexity of the issues involved required a systematic review exploring all aspects of the existing literature and empirical evidence.

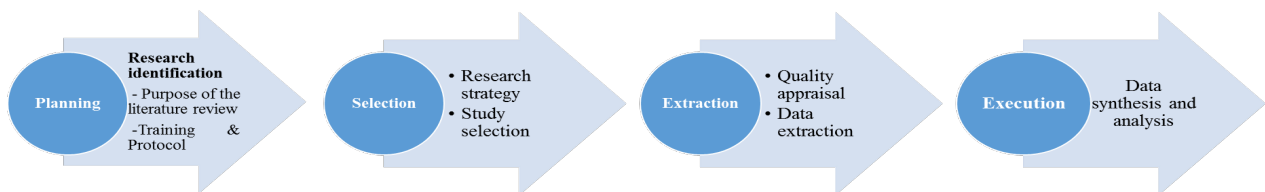
1. Research Methodology :

This study aims to examine the literature on digital transformation. For it, we used a systematic approach following Okoli and Schabram (2010) protocol to review a large number of refereed papers published between 2014 and 2019, from which a large number of documents relating to digital transformation could be extracted, and they were selected for analysis.

The systematic review has allowed us to gather all the relevant and valid information concerning the digital transformation through its rigorous and well-defined approach that perform strict rules and a clearly defined protocol. It aims to limit systematic error (bias), mainly by attempting to identify, appraise, and synthesize all relevant studies by using a specific methodology.

Our systematic review contained four steps following the Okoli and Schabram protocol (Okoli, et al., 2010):

Figure 1. Okoli and Schabram protocol of systematic review (Okoli et al., 2010)



The approach used in this research consisted of both a quantitative and qualitative analysis to reduce potential bias. A qualitative approach is centered on the content of the literature, and a quantitative approach based on Bibliometric review by using "Publish or Perish" a free-of-charge analyzing software program. It uses the Scopus database to obtain the raw citations, then analyzes these and presents the following statistics: Total number of papers, Total number of quotes, Average number of citations per paper, Average number of citations per author, Average number of papers per author, Average number of citations per year, Hirsch's h-index and related parameters, Egghe's g-index, The contemporary h-index, The age-weighted citation rate, Two variations of individual h-indices, An analysis of the number of authors per paper. Both of these approaches were complementary to conduct our study.

1.1 Planning :

- Research Identification :

To achieve the objectives of this paper, a systematic review approach is adopted. As the first step for our study, we specified a problem and reformulated a goal in the form of a clear, structured, and unambiguous question before starting as the protocol indicated. The digital transformation, as well as its impact on industrial business, are of particular interest. For that, we investigated the following questions.

RQ1: Which publication channels are the primary targets for digital transformation?

RQ2: How has the paper publication frequency on the topic of digital transformation changed over time?

RQ3: What are the type of papers (conference/Journal)?

RQ4: How we can define digital transformation on industrial business context?

RQ5: What is the impact of digital transformation on industrial business?

1.2 Selection:

- Research strategy :

The search method used in our study is called a boolean search (AND/OR). We tried to combine different terms using the OR and AND logic operator. The Literature search has focused on scientific articles published in English between 2015 and 2019. A set of relevant keywords were selected through previous articles and paper in the same field or with similar scope, and the final terms used can be seen in table 1. The different compositions of terms were searched in keywords, abstracts, and title. The search string used is : [(“Digital transformation” OR “Industry 4.0” OR “Industrie 4.0” OR “Smart Factory” OR “Digitalization”) AND (“transformation” OR “management” OR “change” OR “strategy”)]

Table 1. search terms and keywords

IT Context “OR”		Transformation Context “OR”
“Digital” “Industry 4.0.” “Industrie 4.0” “Smart factory” “Digitalization”	AND	“transformation” “management” “change” “strategy”

Through the Scopus digital libraries, we have done our research by using different methods with a specific configuration of the search string. Scopus is considered as the largest database of citations and abstracts from peer-reviewed bibliographies and quality websites and has a broad coverage of different disciplines and topics. It includes intelligent tools to track, analyze, and visualize searches.

Table 2. systematic review process

Institute for Scientific information – SCOPUS	
Criteria	Filters
Restriction	Topic (Title, abstract, Keywords)
Documents type	Articles and conference proceedings
Language	English
Years	2014-2019

1.3 Extraction:

- Quality appraisal:

The initial selection was not limited and included papers from other research fields in the results since we did not apply any restrictions. Since the objective of this paper is to provide a comprehensive overview of the research fields that focus on issues concerning digital transformation contexts and explore its impact on industrial business, we refined the search results according to some quality measures.

First, a manual check of the content of the full articles, the abstracts, and the title was performed. Then, we defined selection criteria which studies are included or excluded.

-Inclusion criteria:

- The review should be related to digital transformation and must relate to the research question.
- The publication must have a transparent methodology.
- The research must come from trusted resources and journals
- The publication year of the papers must be published between 2014 and 2019.

-Paper had to be written in English.

-Exclusion criteria:

-The study is an editorial, Keynote, opinion, tutorial, workshop, summary report, poster or paper such as unpublished articles, master's theses, and books. Such documents have been excluded since such articles are usually not peer-reviewed.

-Study's full text is not available.

The exclusion criteria were applied using the OR logical operator between them.

The application of the search string in the Scopus database allowed us to generate 620 articles. We started the articles filtering phase by applying the inclusion criteria. We limited our field of study to journal articles and conference papers published between 2014-2019 and written in English. Then, Based on their title, keywords, abstract, and perhaps the full text, we have been able to select the articles that will allow us to answer the RQs. The exclusion process resulted in a total of 164 papers from the Scopus database.

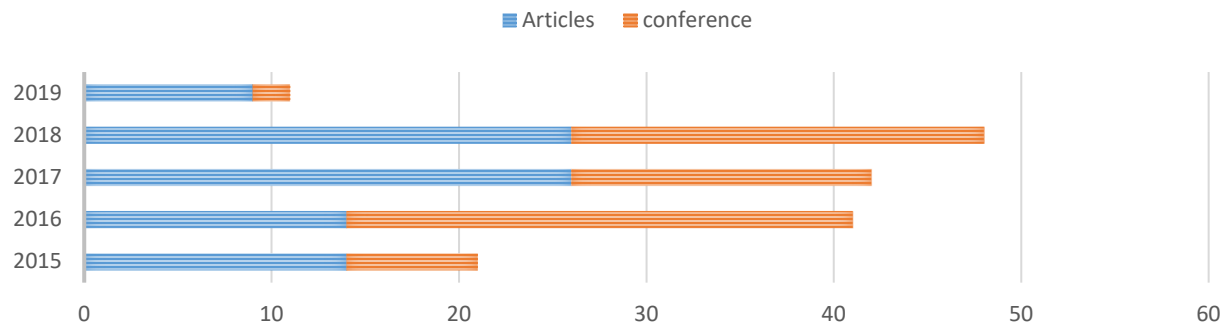
- Data extraction :

a. The occurrence of papers by year of publication

From 2014 to 2018, a large number of papers on digital transformation appears annually. From 2016, the number of papers appeared on the digital transformation significantly increased with an increase of over 20 articles per year. The number of papers published since 2016 is twice as much as before these demonstrate that the field of digital transformation had gained importance.

58% of the total number of papers, journals articles, and 42% are conference proceedings. The emergence of the field is demonstrated by the graph (Fig 2.) that illustrate the 164 papers published over the years. The figure (Fig 2.) shows that the highest percentage of articles published is 29% in 2018, and the lowest one is 7% in 2019, knowing that the work continues in this year, and it is expected the increase in the number of the paper published by the end of the year.

Figure 2. The occurrence of papers per publication year (n=164)



b. Distribution of papers by country of publication:

Besides, a classification of the country that most contributed to the field have been made (**Table 3.**). It has been noted that the countries that have contributed the most are the so-called industrialized countries as Germany, the United States of America, Russia, with 34%, 18%, and 7% respectively. Unsurprisingly, the United States and Germany are at the top of the ranking. Influenced mainly by the size of their markets, these countries also have a strong education and research system as well as a business-friendly environment. Behind these giants, Russia, the United Kingdom, Australia are in the top 5. Even if the results of the digital transformation are less visible in these countries than in the United States and Germany, these countries have fundamentals robust infrastructure, connectivity, and knowledge development.

Table 3. Country classification

Countries	Classification
Germany	34%
USA	18%
Russia	7%
UK	7%
Australia	6%

c. Top 5 authors on the field by citation number :

We also extracted the top 5 authors on the area according to their citations numbers (Table 4.). To be specific at this point, “Publish or Perish” already shows results of Scopus database arranged in order of overall influence and impact. It takes into account various metrics, including the total number of citations.

The most impactful papers focused on the digital transformation strategy and tried to help practitioners with guidelines to face the challenge and risks of digital transformation e.g., (C.Matt et al. , 2015) (T.Hess et al., 2016).

Table 4. Top 5 authors on the field

Authors	Publication	Cites	Cites/year
C.Matt et al. (2015)	Business and information systems Engineering	114	28.50
T.Janowski et al. (2015)	Government Information Quarterly	96	24.00
T.Hess et al. (2016)	MIS Quarterly Executive	71	23.67
A.Majchrzak et al. (2016)	MIS Quarterly: Management Information Systems	53	17.67
R.Hansen et al. (2015)	MIS Quarterly Executive	43	10.75

d. Distribution of papers by Journal :

We also explored the distribution of the articles per journal; the journal that had the largest number of publication in digital transformation was MIS Quarterly Executive, which is a journal that encourages practice-based research in the IS field and disseminates the results of that research into a much more relevant manner to practitioners.

Table 5. Articles distribution per journal

Top 5 Publications Journal	Count	% of 164
MIS Quarterly Executive	12	7.31%
MIT Sloan Management Review	4	2.44%
Future Generation Computer Systems	3	1.83%
International Journal of Civil Engineering and Technology	2	1.22%
Technological Forecasting and Social Change	2	1.22%

We have performed a similar search in the Scopus database with the different term as " digitalization," "industry 4.0", "smart factory," with the same filters, and we found a large number of papers, about 40.000 articles, conference proceedings, and literature review.

1.4 Data synthesis and Qualitative analysis :

1.4.1 Digital Transformation as a new concept:

Digital transformation is a relatively new concept and has reached high popularity among researchers and practitioners in the last couple of years. In perpetual evolution, we are witnessing a real revolution introduced by organizations. To fully understand the concept of digital transformation, we should first define and differentiate between the terms Digitization, digitalization, and digital transformation. The use of these terms until now creates a certain ambiguity within the scientific community since most researchers use the terms interchangeably, whereas, in reality, there is a

significant difference between the terms. It is necessary to distinguish between those three terms. Indeed, Digitization means the conversion from an analog format into a digital format; it is the representation of information with a binary language (0 and 1). It is the representation of information in any computer system. For example, we can scan a photo with a scanner to store it on a CD.

While Digitalization means the use of digital data and technology to automate data handling and optimize processes, it is the use of a computer system to automate or semi-automate processes. From this point of view, computerization is term close to the digitization and is sometimes considered synonymous.

However, Digital transformation is a new concept frequently used by academics and practitioners, but which changes form very often depending on the context in which it is used. As we go through the literature, we have noticed that the term "digital transformation" is very widely used, sometimes wrongly, since there are no formal definitions in the academic literature. Many authors attempted to define it and to discuss its concept, Table 6. Illustrates some unique definitions.

Table 6. current definitions of digital transformation

Definition	Source
Digital transformation strategy is a blueprint that supports companies in governing the transformations that arise owing to the integration of digital technologies, as well as in their operations after a transformation.	Matt et al. (2015)
Digital transformation is concerned with the changes digital technologies can bring about in a company's business model, which result in changed products or organizational structures or the automation of processes. These changes can be observed in the rising demand for Internet-based media, which has led to changes in entire business models (for example, in the music industry).	Hess et al. (2016)
The use of new digital technologies (social media, mobile, analytics, or embedded devices) to enable significant business improvements (such as enhancing customer experience, streamlining operations, or creating new business models).	Liere-Netheler et al. (2018)
Digital transformation as encompassing the digitization of sales and communication channels and the digitization of a firm's offerings (products and services), which replace or augment physical offerings. Furthermore, digital transformation entails tactical and strategic business moves that are triggered by data-driven insights and the launch of digital business models that allow new ways of capturing value.	Horlach et al. (2017)
The use of technology to radically improve performance or reach of enterprises.	*Westerman et al. (2011) *Westerman et al. (2014) Karagiannaki et al. (2017)

The term is quite old, it first appeared in 2000 (Patel & McCarthy, 2000) and was linked to digitization, but now it refers to a phenomenon related to new consumer uses and unique objects that directly impact current business models and organizations. The first strict definition of the term appears in a book by Fors and Stolterman (Fors A. and Stolterman E., 2004), where they described digital transformation as the changes that digital technology entails or influences in all aspects of human life. Other researchers such as (Westerman et al., 2011) define digital transformation as the use of technology to radically improve performance or reach of enterprises, and the creation of new business opportunities through the use of digital data and technology.

It's no longer just business processes or macro processes that are affected by the change, but all business processes, support processes, and the organizational design itself. These processes are entirely dedicated to the creation of value. Indeed, Companies are called upon to rethink their operations and the way they interact with their stakeholders, to adapt to new market behaviors, or to take advantage of technological tools in terms of innovation or productivity. The

digital transformation is a disruptive or incremental change process. It starts with the adoption and use of digital technologies, then evolving into an implicit holistic conversion of an organization, or deliberate in pursuing value creation (Henriette et al., 2016). The different definitions for Digital Transformation (DT) may be categorized into three distinct elements: (1) Technological – DT is based on the use of new digital technologies such as social media, mobile, analytics or embedded devices; (2) Organizational – DT requires a change of organizational processes or the creation of new business models; (3) Social – DT is a phenomenon that is influencing all aspects of human life by, e.g., enhancing customers experience (J. Reis et al., 2018).

Furthermore, Transformational changes are required to implement the digital transformation, which is related to strategy, leadership, and organizational culture. The impacts of DT in any organization can be grouped into three different levels: the transformation of the customer experiences, the transformation of business processes, and the change of business models.

The transformation of consumer experiences in the use of products and services of the organization is expressed in the in-depth study of market segments and their behavior in the marketing space, consumer behavior and loyalty, interactive communication with customers in the sales process and many digital contact points between the organization and the customers (Schwertner, 2017) . Customers are more demanding and expect companies to listen, understand, and be flexible about the evolution of their needs. In companies, users, by using new technologies in private context, expect to use the same techniques at work. Especially for new generations, also known as "digital natives" (Pardo et al., 2014), which are born surrounded by technologies. To bring a satisfying relationship to his client, the organization must think about the coherence of its communication channels and integrate new market monitoring systems, including the analysis of massive data from the Internet, which requires the development of new infrastructures, and new skills.

Transformation of the business processes of the organization covers the automation of R&D, production and distribution processes. Digital technologies also enable the capacity of people to work at different levels in different functional areas. By automating, standardizing and globally sourcing processes, organizations can become more agile, more responsive to changes in demand, and better able to increase and sustain profitability. Increasing distance work at the employees' home, decision-making based on real customer relationship data helps to speed up a decision on the availability of products in different production units (Schwertner, 2017).

Transforming the business model is done through digital business modification, new digital business, and digital globalization. These processes take place by adding digital content to existing products and services and introducing new digital solutions (Schwertner, 2017).

1.4.2 Technology trends in the digital transformation

Big data, cloud computing, the Internet of things, and blockchain are trends that form the technological basis of digital transformation and significantly influence it. Their applications are spread across different industries and departments. With all the benefits of digital technologies, they are also a big challenge for the company. In particular, the use of new technologies requires the networking of various specialist departments and the development of new skills among managers and employees.

- Big Data

On the one hand, big data refers to a large or complex amount of continuously changing data that can no longer be analyzed with conventional analysis methods and data processing tools. On the other hand, this also includes the sum of the data processing technologies and analysis methods that have been developed in recent years to collect and evaluate a large or complex amount of data (Reichert, 2014, p. 40). The characteristics of Big Data can be described by Doug Laney through the three "V's", volume, variety, and velocity. (Laney, 2001).

Big Data includes all data from social networks, call centers, genomic data, biological research, and medicine. In the industry, the proliferation of sensors is fueling companies with massive data. The data describing big data is continually evolving.

In this new context, the key success factor for organizations is recognizing changes and reacting quickly and intelligently. While the essential criteria for the business of the twentieth century have been stability and scale, the new benefits are based on discovery and agility; in this environment, performance is guided by the ability to continually leverage existing and new data sources to identify models and opportunities. (Davenport et al., 2012).

- Internet-of-Things

The term Internet of Things (IoT) refers to the networking of physical objects via sensors and actuators with the Internet or other networked systems. It allows objects to communicate with each other independently and perform tasks for the user. Also, users can track and monitor the status of objects and even remotely control them. Besides, networked sensors also monitor the environment, humans (Fedyk 2016, Manyika et al., 2015). The collected and transmitted data can then be processed using Big data analysis methods and combined with other data, such as the company's ERP or CRM systems.

It automates manual tasks, addresses complex problems and innovates from these new measures and treatments. Currently, the IoT is still in the growth stage. While the number of networked devices was estimated at nine billion in 2015, this number is expected to increase to between 25 and 50 billion devices by 2025 (Manyika et al., 2015). Experts estimate that the IoT will change everyday life in many ways (Manyika et al., 2015). The increasing networking of all areas of life is already clearly recognizable through the growing use of, for example, smartphones or so-called wearables, in other words, body-worn technologies such as smartwatches.

In the context of its application in production and industry, the IoT is known under the slogan "Industry 4.0", "Smart Factory," "Industrial Internet of Things" or the fourth industrial revolution. These terms are understood to mean the networking of company resources such as operating resources or storage systems for independent control and the independent exchange of information (Kagermann, 2014). Also, networking in an industrial context will also impact on the planning, operation, and value creation structures in factories, and will enable optimization and automation of production processes (Kagermann, 2014).

- Blockchain

Blockchain is currently at the top of the Gartner hype cycle (Cearley, Walker, Burke, & Searle, 2017). So it is hardly surprising that the technology, known above all as the basis of the crypto-currency Bitcoin (Nakamoto, 2008), has the potential to change entire branches of economy: Classic banks, insurance or the interaction of machines in production should be provided by the Blockchain technology either replaced or can be automated by programmable contracts that are executed without human intervention or middleman (so-called smart contracts) (Tapscott & Tapscott, 2016). In March 2017, the price of one unit of the cryptocurrency Bitcoin exceeded the value of one ounce of gold for the first time and had since been called Gold 2.0 (Vigna & Eisen, 2017). Currently, Bitcoin and Ethereum's two top-cap cryptocurrencies together have a market capitalization over approximately \$ 80 billion (as at August 2017) and are already accepted as a means of payment in some countries (CoinMarketCap, 2017).

1.4.3 Characteristic and features of the digital transformation

The digital transformation is one of the topics that will occupy the agenda of studies and management of many companies for a long time. It is a permanent trend that is constantly being renewed by new generations of digital technologies. Three characteristics can describe digital transformation.

Firstly, digital transformation is *irreversible*. New digital technologies or new technology deployment concepts may be less effective early in their market launch than existing technologies or their deployment concepts. However, the situation is improving as the transformation comes to maturity, removing pre-established solutions from their dominant position in the market. Thus, the user of a digital innovation does not want to give up the comfort that its use gives him. Renouncing the use of new technologies is unthinkable for many people even temporarily.

Secondly, digital transformation is *inevitable*. The current societal and economic context imposes the innovative use of digital technologies to meet the challenges of urbanization and globalization of economic activities. Nowadays, all companies are called upon to make this transformation to integrate the new digital ecosystem better and achieve this leap towards modernity. Advances in digital technologies are now allowing companies to develop solutions to complex challenges. Digital transformation has reached a threshold of maturity, from which many so far unsolvable problems can be solved.

Finally, Digital transformation processes are still uncertain, but *inevitable* and *progress extremely fast*. The rapid pace of development in digital technologies and their effects in many sectors make it difficult to predict which companies will succeed in their transformation. We can also note an acceleration of innovation and change. Constantly reinventing itself has become the claim of many companies. Competitiveness has long since ceased to rely solely on the physical product, but rather on its integration into an ecosystem of intelligent services.

Digital transformation is inevitable, irreversible, and inevitable. These three characteristics illustrate the fact that the digital transformation of the economy and society is a process that can not be stopped and is in full expansion. While

it is in the process of profoundly modifying the economy and the world of work in a general way, the digital accompanies profound and rapid changes of trades. The possibilities offered by new digital technologies are pushing companies to evaluate their potential for developing existing business models constantly.

Conclusion :

The digital transformation is an area in which the academic literature is most interested, but still requires a more in-depth definition of the concept, a better understanding of the requirements, but also a strategic orientation in a long-term perspective. To provide a better characterization for both research and practice, and therefore, to structure the field of digital transformation, we carried out a systematic review.

In this paper, we have done a systematic literature review on digital transformation. The results of this study show that there is still a large number of documents that attempt to explore it. Therefore, our findings contribute to the ongoing research, and aim at better characterizing, analyzing the field and allowed us to highlight the understanding of digital transformation in organizations and to identify useful research guidelines for future academic projects.

In this study, the time allowed for evaluating all articles is limited. A Large number of articles was published on the different digital library in these five years, but we used only 164 articles belonging to the Scopus digital library for quality assessment. Through this study, new exciting research opportunities have been found for future research. Ultimately, we encourage further work that could provide valuable information to practitioners and support new research and academic findings.

References :

- Aditya, B. (2018). The Role of IT Audit in the Era of Digital Transformation. IOP Conference Series: Materials Science and Engineering, 407(1), ISSN 17578981, doi:10.1088/1757-899X/407/1/012164
- Afanasev, M. (2018). Digital transformation of the knowledge management process. Proceedings of the European Conference on Knowledge Management, ECKM, 1, 1-8, ISSN 20488963
- Ahlemann, F. (2016). How digital transformation shapes corporate IT: Ten theses about the IT organization of the future. Proceedings of the 2016 Federated Conference on Computer Science and Information Systems, FedCSIS 2016, 3-4, doi:10.15439/2016F597
- Ahmad, N. (2018). Dimension data: Enabling our clients' digital transformation journey. NTT Technical Review, 16(10), 14-22, ISSN 13483447
- Al-Ruithe, M. (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, ISSN 18770509, doi:10.1016/j.procs.2018.04.145
- Ambede, A. (2016). Design and Implementation of High-Speed All-Pass Transformation-Based Variable Digital Filters by Breaking the Dependence of Operating Frequency on Filter Order. IEEE Transactions on Very Large Scale Integration (VLSI) Systems, 24(5), 2008-2012, ISSN 10638210, doi:10.1109/TVLSI.2015.2485302
- Andriole, S. (2017). Five myths about digital transformation. MIT Sloan Management Review, 58(3), 20-22, ISSN 15329194
- Ângelo, A. (2017). Digital transformation in the pharmaceutical compounds supply chain: Design of a service ecosystem with e-labeling. Lecture Notes in Business Information Processing, 299, 307-323, ISSN 18651348, doi:10.1007/978-3-319-65930-5_26
- Ardolino, M. (2018). The role of digital technologies for the service transformation of industrial companies. International Journal of Production Research, 56(6), 2116-2132, ISSN 00207543, doi:10.1080/00207543.2017.1324224
- Arribas V., José A., (2018). 3D technology in fashion: from concept to consumer, Journal of Fashion Marketing and Management: An International Journal, Vol. 22 Issue: 2, pp.240-251, https://doi.org/10.1108/JFMM-10-2017-0114
- Babar, Z. (2015). Enterprise architecture in the age of digital transformation. Lecture Notes in Business Information Processing, 215, 438-443, ISSN 18651348, doi:10.1007/978-3-319-19243-7_40
- Barnett, A. (2018). Digital transformation of hospital quality and safety: Real-time data for real-time action. Australian Health Review, ISSN 01565788, doi:10.1071/AH18125
- Basole, R. (2016). Accelerating Digital Transformation: Visual Insights from the API Ecosystem. IT Professional, 18(6), 20-25, ISSN 15209202, doi:10.1109/MITP.2016.105
- Bauer, W. (2018). Working life within a hybrid world – How digital transformation and agile structures affect human functions and increase the quality of work and business performance. Advances in Intelligent Systems and Computing, 594, 3-10, ISSN 21945357, doi:10.1007/978-3-319-60372-8_1
- Bensberg, F. (2016). Digital transformation and IT future issues as mirrored in the job market for IT consultants - Results of an explorative job advertisement analysis. Multikonferenz Wirtschaftsinformatik, MKWI 2016, 2, 1007-1018
- Berge, J. (2018). Digital transformation and IIoT for Oil and gas production. Proceedings of the Annual Offshore Technology Conference, 2, 1204-1213, ISSN 01603663
- Betz, C. (2016). The impacts of digital transformation, Agile, and DevOps on future IT curricula. SIGITE 2016 - Proceedings of the 17th Annual Conference on Information Technology Education, 106, doi:10.1145/2978192.2978205

- Bhavnani, S. (2017). 2017 Roadmap for Innovation—ACC Health Policy Statement on Healthcare Transformation in the Era of Digital Health, Big Data, and Precision Health: A Report of the American College of Cardiology Task Force on Health Policy Statements and Systems of Care. *Journal of the American College of Cardiology*, 70(21), 2696-2718, ISSN 07351097, doi:10.1016/j.jacc.2017.10.018
- Bond, M. (2018). Digital transformation in German higher education: student and teacher perceptions and usage of digital media. *International Journal of Educational Technology in Higher Education*, 15(1), ISSN 23659440, doi:10.1186/s41239-018-0130-1
- Bondar, S. (2017). Agile digital transformation of System-of-Systems architecture models using Zachman framework. *Journal of Industrial Information Integration*, 7, 33-43, ISSN 2452414X, doi:10.1016/j.jii.2017.03.001
- Bondar, S. (2017). Zachman framework in the agile digital transformation. *Advances in Transdisciplinary Engineering*, 5, 67-74, doi:10.3233/978-1-61499-779-5-67
- Borges, L. (2016). Method for simulating dose reduction in digital mammography using the Anscombe transformation. *Medical Physics*, 43(6), 2704-2714, ISSN 00942405, doi:10.1118/1.4948502
- Bullyncx, M. (2015). Computing Primes (1929-1949): Transformations in the Early Days of Digital Computing. *IEEE Annals of the History of Computing*, 37(3), 44-54, ISSN 10586180, doi:10.1109/MAHC.2015.46
- Carcary, M. (2016). A dynamic capability approach to Digital transformation: A focus on key foundational themes. *Proceedings of the European Conference on IS Management and Evaluation, ECIME*, 20-28, ISSN 20488912
- Cearley, D. W., Walker, M. J., Burke, B., & Searle, S. (2017). Top 10 Strategic Technology Trends for 2017: A Gartner Trend Insight Report. URL: <https://www.gartner.com/doc/3645332?srcId=1-6595640685>.
- Chanias, S. (2016). Understanding digital transformation strategy formation: Insights from Europe's automotive industry. *Pacific Asia Conference on Information Systems, PACIS 2016 - Proceedings*
- Chanias, S. (2017). Mastering digital transformation: The path of a financial services provider towards a digital transformation strategy. *Proceedings of the 25th European Conference on Information Systems, ECIS 2017*, 16-31
- Chen, Y. (2016). Effect of digital transformation on organisational performance of SMEs: Evidence from the Taiwanese textile industry's web portal. *Internet Research*, 26(1), 186-212, ISSN 10662243, doi:10.1108/IntR-12-2013-0265
- Conway, P. (2015). Digital transformations and the archival nature of surrogates. *Archival Science*, 15(1), 51-69, ISSN 13890166, doi:10.1007/s10502-014-9219-z
- Davenport, T. H., & Patil, D. (2012). Data Scientist: The Sexiest Job of the 21st Century. *Harvard Business Review*.
- Demirkan, H. (2016). Digital Innovation and Strategic Transformation. *IT Professional*, 18(6), 14-18, ISSN 15209202, doi:10.1109/MITP.2016.115
- Dengler, K. (2018). The impacts of digital transformation on the labour market: Substitution potentials of occupations in Germany. *Technological Forecasting and Social Change*, 137, 304-316, ISSN 00401625, doi:10.1016/j.techfore.2018.09.024
- Diebig, M. (2018). Challenges for psychosocial risk assessment during the digital transformation of industry: A qualitative interview study. *Zeitschrift für Arbeits- und Organisationspsychologie*, 62(2), 53-67, ISSN 09324089, doi:10.1026/0932-4089/a000265
- Dolber, B. (2016). Blindspots and Blurred Lines: Dallas Smythe, the Audience Commodity, and the Transformation of Labor in the Digital Age. *Sociology Compass*, 10(9), 747-755, ISSN 17519020, doi:10.1111/soc4.12387
- Dremel, C. (2017). How AUDI AG established big data analytics in its digital transformation. *MIS Quarterly Executive*, 16(2), 81-100, ISSN 15401960
- Ebert, C. (2016). Requirements Engineering for the Digital Transformation: Industry Panel. *Proceedings - 2016 IEEE 24th International Requirements Engineering Conference, RE 2016*, 4-5, doi:10.1109/RE.2016.21
- Evsutin, O. (2018). The adaptive algorithm of information unmistakable embedding into digital images based on the discrete Fourier transformation. *Multimedia Tools and Applications*, 77(21), 28567-28599, ISSN 13807501, doi:10.1007/s11042-018-6055-9
- Faris, D. (2015). Multiplicities of Purpose: The Auditorium Building, the State, and the Transformation of Arab Digital Media. *International Journal of Middle East Studies*, 47(2), 343-347, ISSN 00207438, doi:10.1017/S0020743815000082
- Fedyk, A. (2016). How to Tell If Machine Learning Can Solve Your Business Problem. *Harvard Business Review*.
- Feng, Z. (2015). A polarized digital shearing speckle pattern interferometry system based on temporal wavelet transformation. *Review of Scientific Instruments*, 86(9), ISSN 00346748, doi:10.1063/1.4929533
- Ferreira, M. (2017). Organizational training within digital transformation: The ToOW model. *ICEIS 2017 - Proceedings of the 19th International Conference on Enterprise Information Systems*, 2, 526-532
- Frank, A. (2019). Servitization and Industry 4.0 convergence in the digital transformation of product firms: A business model innovation perspective. *Technological Forecasting and Social Change*, 141, 341-351, ISSN 00401625, doi:10.1016/j.techfore.2019.01.014
- Fritze, M. (2019). Digital transformation and possession attachment: examining the endowment effect for consumers' relationships with hedonic and utilitarian digital service technologies. *Electronic Commerce Research*, 19(2), 311-337, ISSN 13895753, doi:10.1007/s10660-018-9309-8
- Fuchs, C. (2018). Becoming agile in the digital transformation: The process of a large-scale agile transformation. *International Conference on Information Systems 2018, ICIS 2018*
- Ge, Q. (2015). A new digital Gaussian pulse shaping algorithm based on bilinear transformation. *Nuclear Science and Techniques*, 26(1), ISSN 10018042, doi:10.13538/j.1001-8042/nst.26.010402
- Geiger, V. (2016). Transformations of teaching and learning through digital technologies. *Research in Mathematics Education in Australasia 2012-2015*, 255-280, doi:10.1007/978-981-10-1419-2_13
- Gobble, M. (2018). Digital Strategy and Digital Transformation. *Research Technology Management*, 61(5), 66-71, ISSN 08956308, doi:10.1080/08956308.2018.1495969
- Goerzig, D. (2018). Enterprise Architectures for the Digital Transformation in Small and Medium-sized Enterprises. *Procedia CIRP*, 67, 540-545, ISSN 22128271, doi:10.1016/j.procir.2017.12.257
- Goes, P. (2015). Big data - Analytics engine for digital transformation: Where is is?. *2015 Americas Conference on Information Systems, AMCIS 2015*

- Gölzer, P. (2017). Data-driven operations management: organisational implications of the digital transformation in industrial practice. *Production Planning and Control*, 28(16), 1332-1343, ISSN 09537287, doi:10.1080/09537287.2017.1375148
- Gopal, G. (2019). Digital transformation in healthcare - Architectures of present and future information technologies. *Clinical Chemistry and Laboratory Medicine*, 57(3), 328-335, ISSN 14346621, doi:10.1515/cclm-2018-0658
- Gray, J. (2017). Models for the digital transformation. *Software and Systems Modeling*, 16(2), 307-308, ISSN 16191366, doi:10.1007/s10270-017-0596-7
- Gurusamy, K. (2016). An integrated framework for design thinking and agile methods for digital transformation. *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, 9746, 34-42, ISSN 03029743, doi:10.1007/978-3-319-40409-7_4
- Hafsi, M. (2016). What enterprise architecture can bring for digital transformation: An exploratory study. *Proceedings - CBI 2016: 18th IEEE Conference on Business Informatics*, 2, 83-89, doi:10.1109/CBI.2016.55
- Hansen, R. (2015). Hummel's digital transformation toward omnichannel retailing: Key lessons learned. *MIS Quarterly Executive*, 14(2), 51-66, ISSN 15401960
- Hashemi, S. Sofkova (2017). Making room for the transformation of literacy instruction in the digital classroom. *Journal of Early Childhood Literacy*, 17(2), 221-253, ISSN 14687984, doi:10.1177/1468798416630779
- Hausberg, Johann Piet and Lierre-Netheler, Kirsten and Packmohr, Sven and Pakura, Stefanie and Vogelsang, Kristin, Digital Transformation in Business Research: A Systematic Literature Review and Analysis (April 26, 2018). DRUID18, Copenhagen Business School, Copenhagen, Denmark. Available at SSRN: <https://ssrn.com/abstract=3169203>
- Herzog, K. (2017). The digital transformation of steel production. *AISTech - Iron and Steel Technology Conference Proceedings*, 3, 3075-3082, ISSN 15516997
- Heavin, C. (2018). Challenges for digital transformation—towards a conceptual decision support guide for managers. *Journal of Decision Systems*, 27, 38-45, ISSN 12460125, doi:10.1080/12460125.2018.1468697
- Heilig, L. (2017). Digital transformation in maritime ports: analysis and a game theoretic framework. *NETNOMICS: Economic Research and Electronic Networking*, 18(2), 227-254, ISSN 13859587, doi:10.1007/s11066-017-9122-x
- Henriette, Emily, Mondher Feki, and Imed Boughzala. "The Shape of Digital Transformation: A Systematic," n.d.
- Herlitschka, S. (2017). Digital transformation: How industry and society are remodeling as the analog becomes more and more digital. *Elektrotechnik und Informationstechnik*, 134(7), 340-343, ISSN 0932383X, doi:10.1007/s00502-017-0518-y
- Herrmann, M. (2018). Digital transformation and disruption of the health care sector: Internet-based observational study. *Journal of Medical Internet Research*, 20(3), ISSN 14388871, doi:10.2196/jmir.9498
- Hess, T. (2016). Options for formulating a digital transformation strategy. *MIS Quarterly Executive*, 15(2), 123-139, ISSN 15401960
- Hinings, B. (2018). Digital innovation and transformation: An institutional perspective. *Information and Organization*, 28(1), 52-61, ISSN 14717727, doi:10.1016/j.infoandorg.2018.02.004
- Hobbs, M. (2017). Liquid love? Dating apps, sex, relationships and the digital transformation of intimacy. *Journal of Sociology*, 53(2), 271-284, ISSN 14407833, doi:10.1177/1440783316662718
- Horlach, B. (2016). Bimodal IT: Business-IT alignment in the age of digital transformation. *Multikonferenz Wirtschaftsinformatik, MKWI 2016*, 3, 1417-1428
- Horlach, B., Drews, P., Schirmer, I. and T. Böhm (2017). "Increasing the Agility of IT Delivery: Five Types of Bimodal IT Organization." In: *Proceedings of the Hawaiian International Conference on System Sciences*. Hawaii: USA.
- Horlacher, A. (2016). Co-creating value - The dyadic CDO-CIO relationship during the digital transformation. *24th European Conference on Information Systems, ECIS 2016*
- Horlacher, A. (2016). Crossing boundaries: Organization design parameters surrounding CDOs and their digital transformation activities. *AMCIS 2016: Surfing the IT Innovation Wave - 22nd Americas Conference on Information Systems*
- Horlacher, A. (2016). What does a chief digital officer do? Managerial tasks and roles of a new C-level position in the context of digital transformation. *Proceedings of the Annual Hawaii International Conference on System Sciences*, 2016, 5126-5135, ISSN 15301605, doi:10.1109/HICSS.2016.634
- Hsu, C. (2018). The evolving role of IT Departments in digital transformation. *Sustainability (Switzerland)*, 10(10), ISSN 20711050, doi:10.3390/su10103706
- Huang, J. (2018). Building intelligence in digital transformation. *Journal of Integrated Design and Process Science*, 21(4), 1-4, ISSN 10920617, doi:10.3233/jid-2018-0006
- İnel, M. (2019). An empirical study on measurement of efficiency of digital transformation by using data envelopment analysis. *Management Science Letters*, 9(4), 549-556, ISSN 19239335, doi:10.5267/j.msl.2019.1.008
- Ismagilov, I. (2016). Algorithms of quasi evaluation of polynomial trend of the digital signals based on oblique discrete walsh transformations. *2016 2nd International Conference on Industrial Engineering, Applications and Manufacturing, ICIEAM 2016 - Proceedings*, doi:10.1109/ICIEAM.2016.7911545
- Issa, A. (2018). Industrie 4.0 roadmap: Framework for digital transformation based on the concepts of capability maturity and alignment. *Procedia CIRP*, 72, 973-978, ISSN 22128271, doi:10.1016/j.procir.2018.03.151
- Jedlowski, A. (2015). Across media: Mobility and transformation of cultural materials in the digital age. *Journal of African Media Studies*, 7(1), 3-9, ISSN 2040199X, doi:10.1386/jams.7.1.3_2
- Kagermann, H. (2014). Chancen von Industrie 4.0 nutzen. In: T. Bauernhansl, M. ten Hompel, & B. Vogel-Heuse (Hrsg.), *Industrie 4.0 in Produktion, Automatisierung und Logistik* (S. 603-614). Wiesbaden, Deutschland: Springer Vieweg.
- Kaivo-Oja, J. (2017). Futures of robotics. Human work in digital transformation. *International Journal of Technology Management*, 73(4), 176-205, ISSN 02675730, doi:10.1504/IJTM.2017.083074
- Karapetyants, I. (2017). Transformation of logistical processes in digital economy. *Proceedings of the 30th International Business Information Management Association Conference, IBIMA 2017 - Vision 2020: Sustainable Economic development, Innovation Management, and Global Growth*, 2017, 838-844

- Khalid, J. (2018). Promising digital university: A pivotal need for higher education transformation. *International Journal of Management in Education*, 12(3), 264-275, ISSN 1750385X, doi:10.1504/IJME.2018.092868
- Khitskov, E. (2017). Digital transformation of society: Problems entering in the digital economy. *Eurasian Journal of Analytical Chemistry*, 12(5), 855-873, ISSN 13063057, doi:10.12973/ejac.2017.00216a
- Klotzer, C. (2017). The Evolution of Cyber-Physical Systems as a Driving Force behind Digital Transformation. *Proceedings - 2017 IEEE 19th Conference on Business Informatics, CBI 2017*, 2, 5-14, doi:10.1109/CBI.2017.8
- Knoche, M. (2015). The media industry's structural transformation in capitalism and the role of the state: Media economics in the age of digital communications. *TripleC*, 14(1), 18-47, ISSN 1726670X
- Korhonen, J. (2017). Enterprise architecture for digital transformation. *Proceedings - 2017 IEEE 19th Conference on Business Informatics, CBI 2017*, 1, 349-358, doi:10.1109/CBI.2017.45
- Korpela, K. (2016). Digital business ecosystem transformation - Towards cloud integration. *Proceedings of the Annual Hawaii International Conference on System Sciences*, 2016, 3959-3968, ISSN 15301605, doi:10.1109/HICSS.2016.491
- Kotarba, M. (2018). Digital transformation of business models. *Foundations of Management*, 10(1), 123-142, ISSN 20807279, doi:10.2478/fman-2018-0011
- Kröger, N. (2016). IT consultants as change agents in digital transformation initiatives. *Multikonferenz Wirtschaftsinformatik, MKWI 2016*, 2, 1019-1030
- Kuhn, S. (2018). Medicine in the digital age: Transformation through education. *Deutsches Arzteblatt International*, 115(14), ISSN 18660452
- Kutzner, K. (2018). Digital transformation in information systems research: A taxonomy-based approach to structure the field. *26th European Conference on Information Systems: Beyond Digitization - Facets of Socio-Technical Change, ECIS 2018*
- Kwok, N. (2016). Color enhancement for images from digital camera using a transformation-free approach. *Proceedings of the International Conference on Sensing Technology, ICST*, 2016, 168-172, ISSN 21568065, doi:10.1109/ICST.2015.7438385
- Laney, D. (2001). *3D Data Management: Controlling Data Volume, Velocity and Variety*.
- Lederer, M. (2017). The digital future has many names - How business process management drives the digital transformation. *2017 6th International Conference on Industrial Technology and Management, ICITM 2017*, 22-26, doi:10.1109/ICITM.2017.7917889
- Leipzig, T. von (2017). Initialising Customer-orientated Digital Transformation in Enterprises. *Procedia Manufacturing*, 8, 517-524, ISSN 23519789, doi:10.1016/j.promfg.2017.02.066
- Leonhardt, D. (2017). Reinventing the it function: The role of IT agility and IT ambidexterity in supporting digital business transformation. *Proceedings of the 25th European Conference on Information Systems, ECIS 2017*, 968-984
- Li, F. (2018). The digital transformation of business models in the creative industries: A holistic framework and emerging trends. *Technovation*, ISSN 01664972, doi:10.1016/j.technovation.2017.12.004
- Li, L. (2018). Digital transformation by SME entrepreneurs: A capability perspective. *Information Systems Journal*, 28(6), 1129-1157, ISSN 13501917, doi:10.1111/isj.12153
- Lichtenthaler, U. (2017). Shared value innovation: Linking competitiveness and societal goals in the context of digital transformation. *International Journal of Innovation and Technology Management*, 14(4), ISSN 02198770, doi:10.1142/S0219877017500183
- Loonam, J. (2018). Towards digital transformation: Lessons learned from traditional organizations. *Strategic Change*, 27(2), 101-109, ISSN 10991697, doi:10.1002/jsc.2185
- Majchrzak, A. (2016). Designing for digital transformation: Lessons for information systems research from the study of ICT and societal challenges. *MIS Quarterly: Management Information Systems*, 40(2), 267-277, ISSN 02767783, doi:10.25300/MISQ/2016/40
- Makhovikov, A. (2019). Digital transformation in oil and gas extraction. *Innovation-Based Development of the Mineral Resources Sector: Challenges and Prospects - 11th conference of the Russian-German Raw Materials*, 2018, 531-538
- Makowski, P. (2018). Digital hologram transformations for RGB color holographic display with independent image magnification and translation in 3D. *Applied Optics*, 57(1), ISSN 1559128X, doi:10.1364/AO.57.000A76
- Malmelin, N. (2017). Media work in change: Understanding the role of media professionals in times of digital transformation and convergence. *Sociology Compass*, 11(7), ISSN 17519020, doi:10.1111/soc4.12494
- Manyika, J., Chui, M., Bisson, P., Woetzel, S., Dobbs, R., Bughin, J., & Aharon, D. (2015). *The Internet of Things: Mapping the Value Beyond the Hype*.
- Matt, C. (2015). Digital Transformation Strategies. *Business and Information Systems Engineering*, 57(5), 339-343, ISSN 18670202, doi:10.1007/s12599-015-0401-5
- Memmolo, P. (2015). Coding Color Three-Dimensional Scenes and Joining Different Objects by Adaptive Transformations in Digital Holography. *IEEE/OSA Journal of Display Technology*, 11(10), 854-860, ISSN 1551319X, doi:10.1109/JDT.2015.2407615
- Meske, C. (2018). Global adoption of unified communication technologies as part of digital transformation in organizations: A cross-cultural perspective. *MKWI 2018 - Multikonferenz Wirtschaftsinformatik*, 2018, 133-144
- Midttun, A. (2017). Facing the climate and digital challenge: European energy industry from boom to crisis and transformation. *Energy Policy*, 108, 330-343, ISSN 03014215, doi:10.1016/j.enpol.2017.05.046
- Mikalsen, M. (2018). Agile digital transformation: A case study of interdependencies. *International Conference on Information Systems 2018, ICIS 2018*
- Ndemo, B. (2017). Making Sense of Africa's Emerging Digital Transformation and its Many Futures. *Africa Journal of Management*, 3(3), 328-347, ISSN 23322373, doi:10.1080/23322373.2017.1400260
- Nissen, V. (2018). The role of IT-management in the digital transformation of Russian companies. *Foresight and STI Governance*, 12(3), 53-61, ISSN 25002597, doi:10.17323/2500-2597.2018.3.53.61
- Nwankpa, J. (2016). IT capability and digital transformation: A firm performance perspective. *2016 International Conference on Information Systems, ICIS 2016*
- Ohali, Y. Al (2018). Digital transformation of education in the kingdom of Saudi Arabia: Deploying a country-wide learning management system for K-12 education. *Proceedings of the European Conference on e-Learning, ECEL*, 2018, 1-9, ISSN 20488637
- Okoli, Chitu, and Kira Schabram. (2010). *A Guide to Conducting a Systematic Literature Review of Information Systems Research*

- Olcott, D. (2015). Ethics and education in the digital age: Global perspectives and strategies for local transformation in Catalonia. *RUSC Universities and Knowledge Society Journal*, 12(2), 59-72, ISSN 1698580X, doi:10.7238/rusc.v12i2.2455
- Olleros, F. (2016). Digital transformations: An introduction. *Research Handbooks on Digital Transformations*, 1-19, doi:10.4337/9781784717766
- Omar, A. (2016). Digital-enabled service transformation in public sector: Institutionalization as a product of interplay between actors and structures during organisational change. *ACM International Conference Proceeding Series*, 1, 305-312, doi:10.1145/2910019.2910080
- Oswald, G. (2016). Shaping the digital enterprise: Trends and use cases in digital innovation and transformation. *Shaping the Digital Enterprise: Trends and Use Cases in Digital Innovation and Transformation*, 1-335, doi:10.1007/978-3-319-40967-2
- Pardo, A. and C. Etay (2014). "Movies and screens: the Spanish audience's choice." *Communication & Society* 27 (4), 131-145.
- Paschek, D. (2017). Automated business process management-in times of digital transformation using machine learning or artificial intelligence. *MATEC Web of Conferences*, 121, ISSN 2261236X, doi:10.1051/mateconf/201712104007
- Patel, K., McCarthy, M.P. (2000). *Digital Transformation: The Essentials of E-Business Leadership 1st*, McGraw-Hill Professional 2000
- Pavlekovskaya, I. (2018). The impact of digital transformation of the Russian economy on knowledge management processes. *Proceedings of the European Conference on Knowledge Management, ECKM*, 2, 677-684, ISSN 20488963
- Peicheva, D. (2016). The transformation of reading among the ageing population in the digital age. *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, 9754, 216-225, ISSN 03029743, doi:10.1007/978-3-319-39943-0_21
- Pflaum, A. (2018). The IoT and digital transformation: Toward the data-driven enterprise. *IEEE Pervasive Computing*, 17(1), 87-91, ISSN 15361268, doi:10.1109/MPRV.2018.011591066
- Piccinini, E. (2015). Transforming industrial business: The impact of digital transformation on automotive organizations. *2015 International Conference on Information Systems: Exploring the Information Frontier, ICIS 2015*
- Piccinini, E. (2016). The future of personal urban mobility - Towards digital transformation. *Multikonferenz Wirtschaftsinformatik, MKWI 2016*, 1, 55-66
- Pilik, M. (2017). On-line shopping behaviour in the Czech Republic under the digital transformation of economy. *Economic Annals-XXI*, 165(5), 119-123, ISSN 17286220, doi:10.21003/ea.V165-24
- Poling, W. (2016). Combined Synchrotron X-Ray Diffraction and Digital Image Correlation Technique for Measurement of Austenite Transformation with Strain in TRIP-Assisted Steels. *SAE Technical Papers*, ISSN 01487191, doi:10.4271/2016-01-0419
- Priya, S. (2018). Paillier homomorphic cryptosystem with poker shuffling transformation based water marking method for the secured transmission of digital medical images. *Personal and Ubiquitous Computing*, 22(5), 1141-1151, ISSN 16174909, doi:10.1007/s00779-018-1131-8
- Prokopenko, N. (2016). Synthesis of k-valued digital IP-modules for robots and sensor systems based on linear transformations of current logic signals. *SPIIRAS Proceedings*, 2(45), 172-189, ISSN 20789181, doi:10.15622/SP.45.11
- Pyka, A. (2017). Dedicated innovation systems to support the transformation towards sustainability: Creating income opportunities and employment in the knowledge-based digital bioeconomy. *Journal of Open Innovation: Technology, Market, and Complexity*, 3(4), ISSN 21998531, doi:10.1186/s40852-017-0079-7
- Quinn, L. (2016). Troubled waters: the transformation of marketing in a digital world. *European Journal of Marketing*, 50(12), 2103-2133, ISSN 03090566, doi:10.1108/EJM-08-2015-0537
- Ramesh, R. (2016). Architecting digital transformation. *Cutter IT Journal*, 29(8), ISSN 15227383
- Reichert, R. (2014). Big Data: Medienkultur im Umbruch. In: H. Ortner, D. Pfurtscheller, M. Rizzolli, & A. Wiesinger (Hrsg.), *Datenflut und Informationskanäle* (S. 37-54). Innsbruck, Österreich: Innsbruck University Press.
- Reis, J. (2018). Digital transformation: A literature review and guidelines for future research. *Advances in Intelligent Systems and Computing*, 745, 411-421, ISSN 21945357, doi:10.1007/978-3-319-77703-0_41
- Reis, João, Marlene Amorim, Nuno Melão, and Patrícia Matos (2018). "Digital Transformation: A Literature Review and Guidelines for Future Research." In *Trends and Advances in Information Systems and Technologies*, edited by Álvaro Rocha, Hojjat Adeli, Luís Paulo Reis, and Sandra Costanzo, 745:411-21. Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-77703-0_41.
- Riasanow, T. (2017). Digital transformation in the automotive industry: Towards a generic value network. *Proceedings of the 25th European Conference on Information Systems, ECIS 2017*, 3191-3201
- Robinson, S. (2019). Locating the "Digital" in Digital Journalism Studies: Transformations in Research. *Digital Journalism*, 7(3), 368-377, ISSN 21670811, doi:10.1080/21670811.2018.1557537
- Roedder, N. (2016). The digital transformation and smart data analytics: An overview of enabling developments and application areas. *Proceedings - 2016 IEEE International Conference on Big Data, Big Data 2016*, 2795-2802, doi:10.1109/BigData.2016.7840927
- Rowe, F. (2018). Being critical is good, but better with philosophy! From digital transformation and values to the future of IS research. *European Journal of Information Systems*, 27(3), 380-393, ISSN 0960085X, doi:10.1080/0960085X.2018.1471789
- Sajić, M. (2018). Digital technologies in transformation of classical retail bank into digital bank. *2017 25th Telecommunications Forum, TELFOR 2017 - Proceedings*, 2017, 1-4, doi:10.1109/TELFOR.2017.8249404
- Sathananthan, S. (2018). Realizing digital transformation through a digital business model design process. *Joint 13th CTTE and 10th CMI Conference on Internet of Things - Business Models, Users, and Networks*, 2018, 1-8, doi:10.1109/CTTE.2017.8260996
- Saul, C. (2018). Digital transformation as an enabler for advanced services in the sanitation sector. *Sustainability (Switzerland)*, 10(3), ISSN 20711050, doi:10.3390/su10030752
- Savoia, R. (2015). Investigation on Axicon Transformation in Digital Holography for Extending the Depth of Focus in Bio-Microfluidics Applications. *IEEE/OSA Journal of Display Technology*, 11(10), 861-866, ISSN 1551319X, doi:10.1109/JDT.2015.2395074
- Schagerl, M. (2016). Readiness model for industry 4.0 - The path to digital transformation. *Productivity Management*, 21(4), 40-42, ISSN 18688519
- Schallmo, D. (2017). Digital transformation of business models-best practice, enablers, and roadmap. *International Journal of Innovation Management*, 21(8), ISSN 13639196, doi:10.1142/S136391961740014X

- Schumann, C. (2015). Digital business transformation in the context of knowledge management. *Proceedings of the European Conference on Knowledge Management, ECKM*, 671-675, ISSN 20488963
- Schwarz Müller, T. (2018). How does the digital transformation affect organizations? Key themes of change in work design and leadership. *Management Revue*, 29(2), 114-138, ISSN 09359915, doi:10.5771/0935-9915-2018-2-114
- Schwertner, K. (2017). Digital Transformation of Business. *Trakia Journal of Science* 15, no. Suppl.1 : 388-93. <https://doi.org/10.15547/tjs.2017.s.01.065>.
- Sebastian, I. (2017). How big old companies navigate digital transformation. *MIS Quarterly Executive*, 16(3), 197-213, ISSN 15401960
- Seifert, H. (2016). Virtualization of consulting services: State of research on the digital transformation in management consultancy and other research needs. *Multikonferenz Wirtschaftsinformatik, MKWI 2016*, 2, 1031-1040
- Singh, A. (2017). How chief digital officers promote the digital transformation of their companies. *MIS Quarterly Executive*, 16(1), 1-17, ISSN 15401960
- Steene, S. Van De (2017). Digital transformation for prisons: Developing a needs-based strategy. *Probation Journal*, 64(3), 256-268, ISSN 02645505, doi:10.1177/0264550517723722
- Stolterman E., Fors A.C. (2004) Information Technology and the Good Life. In: Kaplan B., Truex D.P., Wastell D., Wood-Harper A.T., DeGross J.I. (eds) *Information Systems Research. IFIP International Federation for Information Processing*, vol 143. Springer, Boston, MA
- Stureson, L. (2018). Effects of the Digital Transformation: Qualitative Study on the Disturbances and Limitations of Using Video Visits in Outpatient Care. *Journal of medical Internet research*, 20(6), ISSN 14388871, doi:10.2196/jmir.9866
- Suárez-Guerrero, C. (2016). Teachers' perceptions of the digital transformation of the classroom through the use of tablets: A study in Spain. *Comunicar*, 24(49), 81-89, ISSN 11343478, doi:10.3916/C49-2016-08
- Sullivan, C. (2018). Digital disruption 'syndromes' in a hospital: Important considerations for the quality and safety of patient care during rapid digital transformation. *Australian Health Review*, 42(3), 294-298, ISSN 01565788, doi:10.1071/AH16294
- Tan, F. (2017). Beyond 'moneyball' to analytics leadership in sports: An ecological analysis of FC Bayern Munich's digital transformation. *AMCIS 2017 - America's Conference on Information Systems: A Tradition of Innovation*, 2017
- Tapscott, D., & Tapscott, A. (2016). *Blockchain Revolution: How the Technology Behind Bitcoin is Changing Money, Business and the World*. New York, NY: Penguin Random House
- Troshani, I. (2018). Digital transformation of business-to-government reporting: An institutional work perspective. *International Journal of Accounting Information Systems*, 31, 17-36, ISSN 14670895, doi:10.1016/j.accinf.2018.09.002
- Trukhachev, V. (2019). Personnel training for the agricultural sector in terms of digital transformation of the economy: Trends, prospects and limitations. *International Journal of Civil Engineering and Technology*, 10(1), 2145-2155, ISSN 09766308
- Tsymbol, Y. (2016). A digital watermarking scheme based on autoassociative neural networks of the geometric transformations model. *Proceedings of the 2016 IEEE 1st International Conference on Data Stream Mining and Processing, DSMP 2016*, 231-234, doi:10.1109/DSMP.2016.7583547
- Vigna, P., & Eisen, B. (2017). Gold 2.0 (Bitcoin) Price Now Higher Than Gold 1.0 (Gold). *Wallstreet Journal*.
- Villela, K. (2018). Towards ubiquitous RE: A perspective on requirements engineering in the era of digital transformation. *Proceedings - 2018 IEEE 26th International Requirements Engineering Conference, RE 2018*, 205-216, doi:10.1109/RE.2018.00029
- Westerman, G. (2015). Revamping your business through digital transformation. *MIT Sloan Management Review*, 56(3), 2-5, ISSN 15329194
- Westerman, G. (2016). Why digital transformation needs a heart. *MIT Sloan Management Review*, 58(1), ISSN 15329194
- Williams, S. (2015). 'M-apping' sleep? Trends and transformations in the digital age. *Sociology of Health and Illness*, 37(7), 1039-1054, ISSN 01419889, doi:10.1111/1467-9566.12283
- Wolf, M. (2018). Digital transformation in companies – challenges and success factors. *Communications in Computer and Information Science*, 863, 178-193, ISSN 18650929, doi:10.1007/978-3-319-93408-2_13
- Yakovenko, I. (2019). The blockchain technology as a catalyst for digital transformation of education. *International Journal of Mechanical Engineering and Technology*(1), 886-897, ISSN 09766340
- Zaychenko, I. (2018). Enterprise architecture as a means of digital transformation of mining enterprises in the Arctic. *Proceedings of the 31st International Business Information Management Association Conference, IBIMA 2018: Innovation Management and Education Excellence through Vision 2020*, 4652-4659
- Zimmermann, A. (2015). Digital enterprise architecture-transformation for the internet of things. *Proceedings of the 2015 IEEE 19th International Enterprise Distributed Object Computing Conference Workshops and Demonstrations, EDOCW 2015*, 130-138, doi:10.1109/EDOCW.2015.16
- Zimmermann, A. (2015). Evolving enterprise architectures for digital transformations. *Lecture Notes in Informatics (LNI), Proceedings - Series of the Gesellschaft für Informatik (GI)*, 244, 183-194, ISSN 16175468
- Zimmermann, A. (2016). Adaptive enterprise architecture for digital transformation. *Communications in Computer and Information Science*, 567, 308-319, ISSN 18650929, doi:10.1007/978-3-319-33313-7_24
- Zimmermann, A. (2018). Evolution of Enterprise Architecture for Digital Transformation. *Proceedings - IEEE International Enterprise Distributed Object Computing Workshop, EDOCW, 2018*, 87-96, ISSN 15417719, doi:10.1109/EDOCW.2018.00023
- Zinder, E. (2016). Synergy for digital transformation: Person's multiple roles and subject domains integration. *Communications in Computer and Information Science*, 674, 155-168, ISSN 18650929, doi:10.1007/978-3-319-49700-6_16
- Ziyadin, S. (2018). Transformation of basic indicators of socio-economic processes in the digital economy. *Proceedings of the 31st International Business Information Management Association Conference, IBIMA 2018: Innovation Management and Education Excellence through Vision 2020*, 2009-2017
- Ziyadin, S. (2019). Specificity of using information technologies in the digital transformation of event tourism. *International Journal of Civil Engineering and Technology*, 10(1), 998-1010, ISSN 09766308

Biographies

Mohamed-Ilias MAHRAZ holds an MS degree in Supply chain management, from LORRAINE University in Metz, France. Currently, He is a Ph.D. student at Department of industrial engineering with Research Team in modeling and decisions support for systems at Ecole Mohammadia d'Ingénieurs (EMI), Mohamed V University, Morocco. He is interested in ERP systems. His work is focused, more specifically, on examining a Critical Success Factors for ERP implementation in Moroccan organizations.

Dr. Loubna BENABBOU is a Professor of Management Sciences at Université du Québec à Rimouski (UQAR) at Lévis campus. Her research work lies in the application of decision/ management sciences and machine learning techniques to transform data for making better decisions and improving operational processes. Dr. Benabbou has been supervising several undergraduate and graduate students in projects for different Industries related to the areas of Decision Sciences, Machine Learning and Operations Management. Her research related to these fields has been published in international scientific journals and conferences' proceedings. Dr. Benabbou was an associate professor of Industrial Engineering at EMI School of Engineering. She was also a trader at Casablanca stock exchange and financial analyst and risk manager at the Caisse Marocaine des retraites the Moroccan largest intuition fund manager. Dr. Benabbou is an industrial engineer from EMI School of Engineering; she earned an MBA and Ph.D. in Management and Decision Sciences from Laval University.

Dr. Abdelaziz BERRADO is an Associate Professor of Industrial Engineering at EMI School of Engineering at Mohamed V University. He earned MS/BS in Industrial Engineering from the same institution, an MS in Industrial and Systems Engineering from San Jose State University, and a Ph.D. in Decision Systems and Industrial Engineering from Arizona State University. His areas of interest include Data Science, Industrial Statistics, Operations and Supply Chain Modeling, Planning and Control. He published several papers in international scientific journals and conferences' proceedings. He is a member of the IEOM Chapter, INFORMS and IEEE.