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Digital Transformation: A Literature Review and Guidelines for Future Research

João Reis¹(✉), Marlene Amorim², Nuno Melão³, and Patrícia Matos⁴

¹ Department of Military Science and Technologies, and CISD&CINAMIL, Military Academy, Lisbon, Portugal

reis.joao@ua.pt

² Department of Economics, Management and Industrial Engineering and Tourism, and GOVCOPP, Aveiro University, Aveiro, Portugal

mamorim@ua.pt

³ Department of Management and CI&DETS, School of Technology and Management of Viseu, Polytechnic Institute of Viseu, Viseu, Portugal

nmelao@estgv.ipv.pt

⁴ Higher Institute of Social and Political Sciences, and CISD, Lisbon, Portugal

psmatos@tvi.pt

Abstract. The aim of this paper is to provide insights regarding the state of the art of Digital Transformation, and to propose avenues for future research. Using a systematic literature review of 206 peer-reviewed articles, this paper provides an overview of the literature. Among other things, the findings indicate that managers should adapt their business strategy to a new digital reality. This mainly results in the adaptation of processes and operations management. Scholars, for the other side, are also facing challenges, as prior research may not have identified all the opportunities and challenges of Digital Transformation. Furthermore, while the Digital Transformation has expanded to all sectors of activity there are some areas with more prospects of being developed in the future than others.

Keywords: Digital Transformation · Business strategy · Processes Operations · Systematic literature review

1 Introduction

With the rise of new digital technologies, e.g., social networks, mobile, big data, etc., firms in virtually all industries domains are conducting multiple initiatives to explore and exploit their benefits [1, 2]. This frequently involves transformations of key business operations and affects products and processes, as well as organizational structures, as companies need to establish management practices to govern these complex transformations [3]. Thus, the society as a whole is facing a fast and radical change due to the maturation of digital technologies and their ubiquitous penetration of all markets [4]. To add to the increased demand from customers, companies are facing ever tougher competition due to globalization [5] and putting pressure to go digital before others do, seeking to survive and attain competitive advantages [6]. Hence, in

recent years “born digital” pioneers (e.g., Amazon, Facebook and Google) have grown into powerful behemoths, while companies that long dominated their industries found their traditional value proposition under threat [7]. However, despite the multiplicity of technological novelties and recipes for their implementation, whether in business, public governance and private life, real Digital Transformation is taking much longer and facing more difficulties than it has been expected [8]. Unfortunately, there are many recent examples of organizations that have been unable to keep pace with the new digital reality: examples include the bankruptcy of movie-rental Company Blockbuster, largely resulting from those firms’ inability to rapidly develop and implement new digitally-based business models [9]. Successful Digital Transformation requires an organization to develop a wide-range of capabilities, which will vary in importance depending on the business context and the specific organization’s needs. Digital technology needs to become central to how the business operates, and organizations effectively need to re-think and possibly re-invent their business models in order to remain competitive [10]. This article differs from previous literature reviews as it strictly focuses on the concept of Digital Transformation. Several concepts have been advanced to label Digital Transformation (e.g. digitalization, digitation) and whereas they are often used indistinctively in the literature, researchers continuously try to determine their boundaries to avoid overlaps. We felt that it would be not prudent to define several terms in such a short paper; while, at the same time, there was a need to draw attention to Digital Transformation, as few literature reviews were conducted when compared, for instance, with the Digitalization term. Henriette *et al.* [11] conducted a similar systematic literature review, but used a different database (Scopus). Their work also focuses on the vulnerabilities and opportunities of digital transformation, but different contributions arise by emphasizing the impact of digital capabilities on the digital transformation and the explanation on how digitalization transforms business models, operations processes and user experience. Thus, based the literature review, our paper proposes a definition of Digital Transformation, delivers a general overview of the literature, along with some suggestions for future research. To this end, the next section provides a brief description of the methodological approach and is followed by the literature review. We end with some concluding remarks.

2 Methodology

This article follows a systematic literature review method, which adheres closely to a set of scientific methods that aims to limit systematic error (bias), mainly by attempting to identify, appraise and synthesize all relevant studies [12]. Undertaking a review provides the best evidence for informing academics and practitioners by adopting a “replicable, scientific and transparent process” [13]. To reduce potential bias, we adopted two different approaches: a qualitative approach based on a bibliometric analysis and a qualitative approach centered on a content analysis of the literature [14]. Table 1 summarizes the research methodology.

Both approaches should be seen as being “complementary” in acknowledging the structure of the field of study [15]. Other researchers have also conducted identical literature reviews, vide [14]. The data search was conducted on September 17th, 2017,

Table 1. Research methodology

Approach	Description	Content
Quantitative approach	A quantitative characterization of the selected publications	Publications distribution Distribution per author and journal Major research approaches Keywords frequency
Qualitative approach	Content analysis of the selected articles	Digital Transformation definitions Themes and categories

and the selected peer-reviewed database was the Institute for Scientific Information – Web of Science (ISI).

We started with the inclusion criteria by using the “Digital Transformation” term in the topic (title, abstract and keywords). Although different keywords may be considered as a viable alternative, “Digital Transformation” is the phenomenon that we want to study. By adding similar terms to the research, it might lead researchers into a biased understanding, as not all terms have the same meaning (e.g. digitalization, digitation). The search for articles was conducted regardless the time limitations, but we reduced the coverage to journal articles and conference papers. To avoid wrong interpretations, the selected documents had to be written in English (Table 2). The exclusion process resulted in a total of 206 academic articles from the ISI database.

Table 2. Systematic literature review process

Institute for Scientific Information – Web of Science		
Criteria	Filters	Documents
Keyword	“Digital Transformation”	
Restriction	Topic (title, abstract, author keywords)	260
Document type	Articles and conference proceedings	235
Language	English	206

3 Findings

3.1 Quantitative Analysis

Although the number of papers on Digital Transformation evolved over time, it was only after 2014 that their numbers increased significantly. In 2016, 45% of the total number of articles is journal articles and 55% are conference papers, highlighting a high value for conference proceedings (Fig. 1). The countries that most contributed to these publications are the United States of America, Germany and Popular Republic of China, with 21%, 19% and 5%, respectively. The reason behind these numbers, in

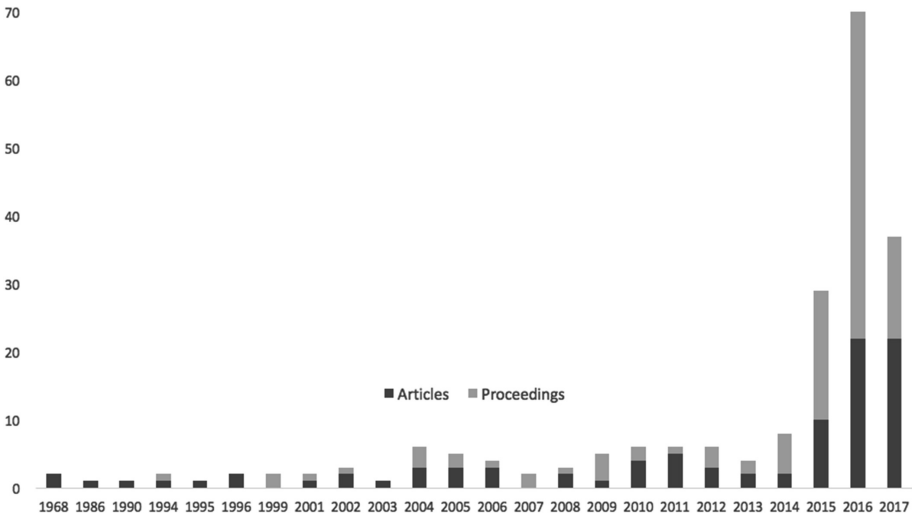


Fig. 1. Publications distribution

those countries, might be due to the adoption of new technologies across the main sectors of activity.

In addition, we evaluated the citation distribution (Table 3). The most cited articles focus on the challenges that innovative technologies bring to firms’ business e.g., [16]. Therefore, they do not examine the post-adoption determinants of digital transformation, in order to understand its effects. Additionally, some other relevant articles rise, while governmental efforts surge to digitalize the Healthcare Systems, as a means to make them safer, accessible and more affordable [17].

We also explored the journal distribution and the quality of those publications by conducting a research on the Incites Journal Citation Reports, which measures the journal’s impact, influence or prestige (Table 4).

The journal that had the largest number of publications in Digital Transformation was the MIS Quarterly Executive, which is a journal with an emphasis on practice-based research, a strong indication that this theme is largely being driven by practitioners. We also observed a significant increase in the number of publications of lower quality in the years of 2016 and 2017. To best of our knowledge, the quality of the research has not declined, since there was simultaneously an increase of high quality publications over the last years. We also reported the main research approaches (methods). The bars from Fig. 2 illustrate the dispersion of each approach.

Although Fig. 2 does not show all research approaches, we considered those that had more incidences. The literature reviews just counted with four occurrences; however, the prevalence of conceptual and illustrative case studies is a clear indication of the lack of maturity of this phenomenon, consequently, future research should focus more on setting the theoretical foundations of the field, based on existing theories or developing new ones. We have performed a similar search in the ISI database (September 23rd, 2017) with the term “Digitalization”, in the topic and with the same

Table 3. Article distribution per author

Top 10 author(s)	Journal	Year	Citations
Karimi and Walter [16]	Journal of Management Information Systems	2015	133
Nagy and Koles [18]	Convergence – The International Journal of Research into New Media Technology	2014	120
Trantopoulos <i>et al.</i> [19]	MIS Quarterly	2017	115
Alos-Simo <i>et al.</i> [20]	Industrial Management & Data Systems	2017	109
Sherer <i>et al.</i> [21]	Information & Management	2016	106
Ranganathan <i>et al.</i> [22]	International Journal of Information Management	2011	101
Agarwal <i>et al.</i> [17]	Information Systems Research	2010	95
Benlian and Haffke [23]	Journal of Strategic Information Systems	2016	94
Chen <i>et al.</i> [24]	Internet Research	2016	84
Schmidt <i>et al.</i> [25]	Practice of Enterprise Modeling	2015	82

Table 4. Article distribution per journal

Top 5 publication journals	Count	Quartile	% of 206
MIS Quarterly Executive	10	Q2	4.854%
Communications in Computer and Information Science	6	–	2.913%
Lecture Notes in Business Information Processing	5	–	2.427%
Digital Transformation and Global Society	4	–	1.942%
Lecture Notes in Computer Science	4	Q4	1.942%

filters, and we found 2,200 documents. This search resulted in a higher number of articles and conference proceedings, but also on literature reviews. It will be valuable for academics to draw more attention to Digital Transformation, as few articles and literature reviews were conducted when compared with other similar terms, but also to try to understand why there is such a big discrepancy between terms. In order to understand the most important research topics, we also collected the most ISI cited keywords (Table 5).

The bars reveal that most common keywords are: Digital Transformation, Digitalization, and Management, by this order. A keyword analysis can provide clues to discover areas for future research, but also to understand which terms are closest to the Digital topic. It is almost self-evident that the top terms are closely related. From our

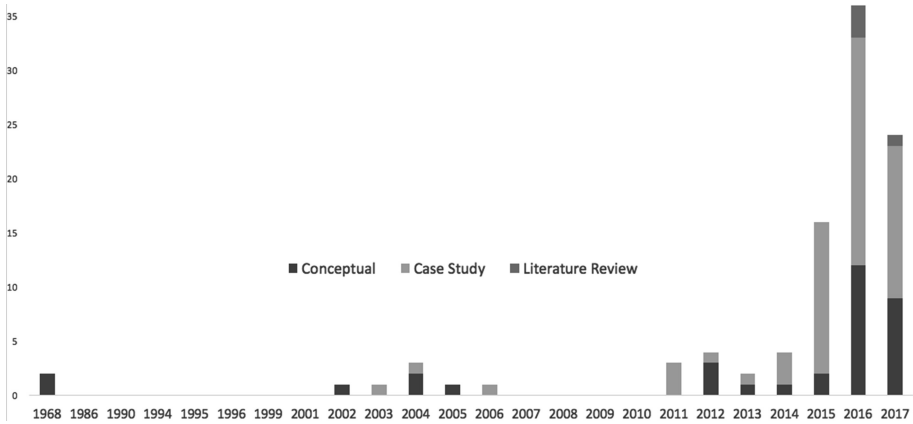


Fig. 2. Major research approaches

Table 5. Keywords frequency (≥ 6 occurrences)

Keyword	Record Count	Bar Chart
Digital Transformation	60	[Horizontal bar]
Digitalization	25	[Horizontal bar]
Management	18	[Horizontal bar]
Internet of Things	13	[Horizontal bar]
Internet	10	[Horizontal bar]
Strategy	9	[Horizontal bar]
Government	9	[Horizontal bar]
Industry 4.0	8	[Horizontal bar]
Innovation	8	[Horizontal bar]
Technology	7	[Horizontal bar]
Enterprise Architecture	7	[Horizontal bar]
Competitive Advantage	6	[Horizontal bar]
Information-Technology	6	[Horizontal bar]
Systems	6	[Horizontal bar]
Educational Technology	6	[Horizontal bar]
Digital Business	6	[Horizontal bar]

analysis, Digital Transformation and Digitalization are similar terms that apply to services, processes and organizational structures throughout IT/IS and web-based enablers; therefore, the connection to management is as vital as companies need to establish management practices to govern these complex transformations [3].

3.2 Qualitative Analysis

As Kokkinakos *et al.* [26] argues that state-of-the-art technologies, like social software, data analytics etc., revolutionize the every-day operations of modern organizations in

every possible level and ways, and, thus, it is expected that Digital Transformation lately constitutes one of the prevalent terms around the World Wide Web; because of its importance, many authors attempt to define and discuss the exact notion of Digital Transformation. This argument reaffirms the importance of defining Digital Transformation, as no formal categorization exists in academic literature and its boundaries are often blurred. The challenge of defining Digital Transformation concept can be tackled after the definitions have been reduced to their basic elements. Table 6 illustrates typical definitions taken from the literature.

Table 6. Digital Transformation Definitions

Author(s)	Definition(s)
Fitzgerald <i>et al.</i> [1]; McDonald and Rowsell-Jones [27]	Use of new digital technologies, such as social media, mobile, analytics or embedded devices, in order to enable major business improvements like enhancing customer experience, streamlining operations or creating new business models [1]. As such, the Digital Transformation goes beyond merely digitizing resources and results in value and revenues being created from digital assets [27]
Solis <i>et al.</i> [28]	The realignment of, or new investment in, technology and business models to more effectively engage digital customers at every touch point in the customer experience lifecycle
Collin <i>et al.</i> [29]; Gimpel and Röglinger [30]; Kane <i>et al.</i> [31]	While digitization commonly describes the mere conversion of analogue into digital information, the terms Digital Transformation and digitalization are used interchangeably and refer to a broad concept affecting politics, business, and social issues
Martin [32]	Digital Transformation is now commonly interpreted as such usage of Information and Communication Technology, when not trivial automation is performed, but fundamentally new capabilities are created in business, public government, and in people's and society life
Westerman <i>et al.</i> [5]	Digital Transformation is defined as the use of technology to radically improve performance or reach of enterprises
Stolterman and Fors [33]	Digital Transformation is the changes that digital technology causes or influences in all aspects of human life

The different definitions for Digital Transformation (DT) may be categorized in 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. Almost all of these topics are used in the researchers' definition of Digital Transformation (Table 6). Therefore, we define Digital Transformation as the use of new digital technologies that enables major business improvements and influences all aspects of customers' life. We also examined the most relevant categories by crossing the most used research areas and ISI cited keywords, as the following (Table 7):

Table 7. Qualitative Analysis

% of 206	Research area	ISI cited keywords	Categories
34%	Information systems	Industry 4.0	IT/IS integration
22%	Business economics	Digital business enterprise architecture	Development of new business models
8%	Education	Educational technology	Training/Education to add new skills
4%	Management science	Management	Process and operations management
1%	Government	Public sector transformation	Ramification to other sectors

Digital Transformation has always had a strong connection to the industry, and is currently re-experiencing huge changes, as the industry 4.0 represents the coming fourth industrial revolution. It focuses on the end-to-end digitization of all physical assets and integration into digital ecosystems with value chain partners [34]. Another significant challenge is to integrate “digital” into the DNA of the business models. This is essential for success of any company and it is becoming a critical management issue [35]. As with any IT-enabled change, it is not enough to bring the IT to the organization [36]; the Digital Transformation success depends on process and operations management changes [37]. To accomplish such management, people must be trained in a change process that takes into account the unique challenges presented by IT [36]. A digital revolution is positively developing the digital and standardized working environments [38]. Some workplaces are being virtualized or remotely controllable, which requires new communications skills and knowledge of virtual worlds [39, 40]. Socially, customers are also acquiring new competences, to be able to engage with digital organizations, in order to subsist in the Digital Era [8]. The digital Era is not only driving innovation in the enterprise sector, it seems to influence developments in the public sector as well [26]. The governmental digitalization is one of the promising themes, with more prospects of being developed in the future. There is also a growing interest in the healthcare sector [41], as there has been a significant research increasing on the digitalization of the healthcare over the past last years [17, 41]. Although we acknowledge the existence of maturity models in this field, having been developed primarily by practitioners (e.g. IDC maturity model), the academic community has not yet elected a consensual maturity model for Digital Transformation that can be applied

to all sectors of activity. Therefore, we propose an in-depth research on the distinction of associated terms to Digital Transformation, and a maturity model to determine the organizational degree of Digital Transformation.

4 Concluding Remarks

Although Digital Transformation is popular among practitioners, this term tends to be neglected in the scholarly literature, and so we decided to conduct this literature review. The aforementioned argument is well evidenced if we conduct a search in ISI database using both terms “Digital Transformation” and “Digitalization”. We present the conclusion from two different perspectives. First, from the cynic viewpoint, Digital Transformation may be considered as a management fashion [42] or as the reincarnation of past IT-enabled change initiatives with new outfits. IT-enabled change resurfaced a few years ago through the business process management movement. As business process management seems to be losing interest, a new buzzword to capture a renewed interest from managers, consultants and software companies. On the other hand, enthusiasts may argue that Digital Transformation includes novel elements that deserve due attention and pose interesting challenges for future research. In particular, the results support that managers should adapt their business strategy to the digital reality, by integrating new technologies in their business models, which raises the importance of processes and operations management topic. Scholars, at the other side, are required to conduct further research to address DT opportunities and challenges. This article has some limitations. As this literature review is limited to a single term, it is possible that some relevant articles are missing. A truly comprehensive approach to produce a systematic literature review also requires the use of more than one digital repository; therefore, by analyzing other repositories besides ISI, the results obtained might be different; however, given that our priority is transparency and easy reproduction of results this choice may be acceptable when comparing the pros and cons. We also believe that the methodology used in this article can be reproduced with other terms. For this reason, we will carry out a new research so that we can compare different terminologies. Furthermore, ISI database is constantly being updated with new peer-review articles. Finally, it should be noted that due to space limitations, this article does not list all the references. References may be provided on request by contacting the first author.

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