

Digital Transformation: A Systematic Literature Review from the Theoretical Lenses of the TOE Framework

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Abstract: Digital transformation (DT) is a topic of the digital world that is neither stable nor clear, since it is a complex concept of diffuse understanding that remains under discussion. Consequently, this article aims to comprehend DT from the theoretical lenses of the technological, organizational, and environmental (TOE) framework. A systematic literature review has been conducted in order to identify the factors, drivers, and barriers of DT within the TOE dimensions. In addition, the orientation of definitions and research on DT will be analyzed from a TOE approach. The main results that emerge from this study suggest that most of the factors in DT are focused on organizational and technological issues, while the environmental factors have received less attention. Our findings provide a broader view of the TOE factors that mediate DT, which offers a better comprehension and conceptualization of this phenomenon. Also, this study suggests three actions that might encompass the DT in a company. These results come from a variety of organizational circumstances that have been presented in the selected literature. Even when we did not focus on a single industry, we were able to get some tendencies about the research in DT.

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TRANSFORMACIÓN DIGITAL: UNA REVISIÓN SISTEMÁTICA DE LA LITERATURA DESDE LA MIRADA TEÓRICA DEL MARCO TOE

Resumen: la transformación digital (TD) es una temática del entorno digital que aún no resulta ser del todo clara, ya que se trata de un concepto complejo y de comprensión difusa que continúa siendo objeto de discusión. Por ello, el presente artículo tiene como objetivo comprender la TD desde la perspectiva teórica del marco tecnológico, organizacional y del entorno (TOE). Con tal fin, se lleva a cabo una revisión sistemática de la literatura que pretende identificar los factores, propulsores y limitantes de la TD dentro de las dimensiones del marco TOE. Asimismo, este trabajo analiza la orientación de las definiciones y la investigación sobre TD desde el enfoque TOE. Los principales hallazgos indican que los determinantes de la TD se centran mayormente en cuestiones organizacionales y tecnológicas, mientras que los factores

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asociados al entorno tradicionalmente han recibido menor atención. Los resultados de esta investigación proporcionan una visión más amplia de los factores del marco TOE que median en la TD, lo que permite una mejor comprensión y conceptualización de este fenómeno, además de proponer tres líneas de acción para el abordaje de la TD por parte de las organizaciones. Estos hallazgos surgen del análisis de diversas situaciones organizacionales reportadas en la literatura seleccionada. Es pertinente mencionar que incluso cuando el enfoque del análisis no se centró en una sola industria, fue posible identificar algunas tendencias en la investigación sobre TD en varios sectores.

Palabras clave: Barreras, transformación digital, propulsores, revisión sistemática de la literatura, marco TOE.

TRANSFORMAÇÃO DIGITAL: UMA REVISÃO SISTEMÁTICA DA LITERATURA DO PONTO DE VISTA TEÓRICO DO MODELO TOE

Resumo: a transformação digital (TD) é um tópico no ambiente digital que ainda não está totalmente claro, pois é um conceito complexo e de compreensão difusa que continua sendo objeto de discussão. Portanto, este artigo tem como objetivo compreender a TD a partir da perspectiva teórica do modelo tecnologia-organização-ambiente (TOE, em inglês). Para isso, é realizada uma revisão sistemática da literatura para identificar os fatores, os motivadores e as limitações da TD dentro das dimensões do modelo TOE. Além disso, neste trabalho, analisa-se a orientação das definições e das pesquisas sobre TD a partir da abordagem TOE. As principais constatações indicam que os determinantes da TD se concentram principalmente em questões organizacionais e tecnológicas, enquanto os fatores associados ao ambiente tradicionalmente recebem menos atenção. Os resultados desta pesquisa fornecem uma visão mais ampla dos fatores do modelo TOE que medeiam a TD, permitindo uma melhor compreensão e conceituação desse fenômeno, além de propor três linhas de ação para as organizações abordarem a TD. Essas conclusões emergem da análise de várias situações organizacionais relatadas na literatura selecionada. É pertinente mencionar que, mesmo quando o foco da análise não estava em uma única indústria, foi possível identificar algumas tendências na pesquisa de DT em vários setores.

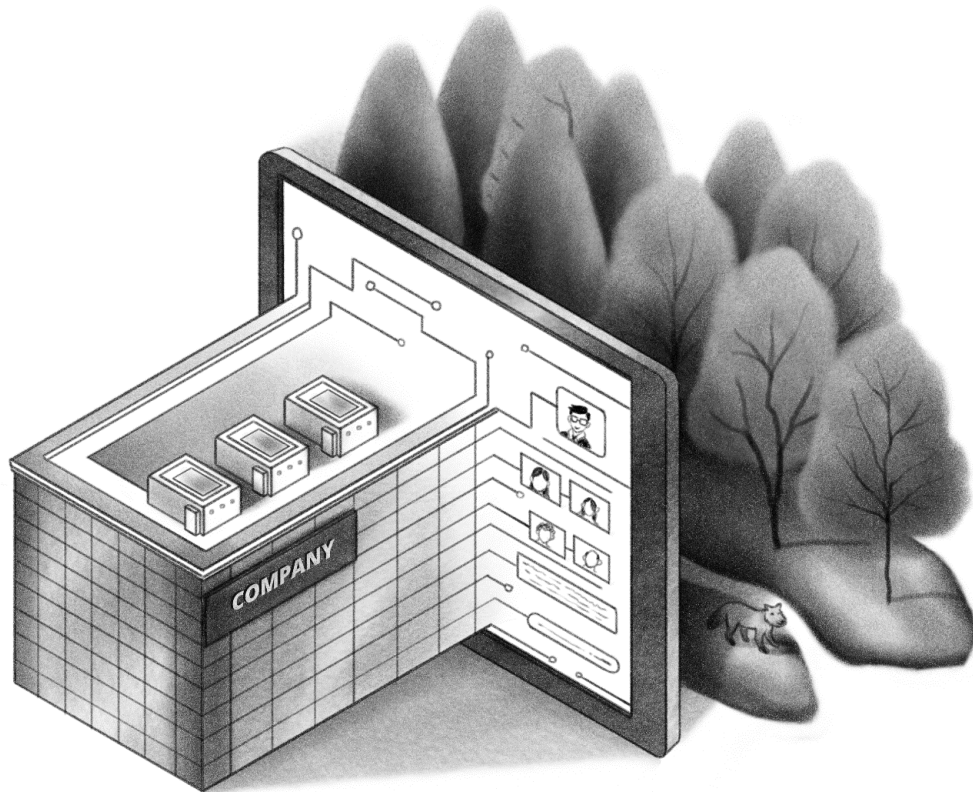
Palavras-chave: barreiras, transformação digital, motivadores, revisão sistemática da literatura, modelo TOE.

INTRODUCTION

Constant innovation in the digital world has caused new challenges for organizations and the labor market (Fodranová, 2021). Digital technology is a key factor that demands management changes to take advantage of its potential in organizational performance (Correa & Díaz, 2018). Therefore, in recent years there has been an increasing interest in research studies focused on digital transformation (DT). Nowadays, DT is a new paradigm of our society (Klein & Todesco, 2021) that, despite its importance, remains under discussion because of the breadth of factors that are related to this phenomenon (Hausberg *et al.*, 2019). Thus, DT is considered a complex concept that has a diffuse understanding where many interpretations coexist (Gong & Ribiere, 2021; Vial, 2019).

Several general understandings could be found concerning DT: i) it can be understood as the use and leverage of digital technologies to achieve radical improvements in organizations (Fitzgerald *et al.*, 2014; Pramanik *et al.*, 2019; Westerman & Bonnet, 2015) or capitalize differential benefits for the companies and their stakeholders (Pani & Pramanik, 2020); ii) it could refer to the culminating point of cultural and strategic changes that occur in organizations that are immersed in a digital environment (Koilada, 2019); iii) it can be seen as an organizational change where business models, structures, operations and relational aspects are shaped by the integration of digital technologies (Hanelt *et al.*, 2021; Henriette *et al.*, 2015), which allows a new pattern for value creation (Gudergan *et al.*, 2019); or iv) it could refer to

the final process after the digitization of information and processes, where cultural and relational changes are generated (Hildebrandt *et al.*, 2019; Mergel *et al.*, 2019).



Based on the above, DT could involve elements concerning the adoption and integration of digital technologies, organizational practices, decision making, and business models, which should be adjusted to the need of the actors of a digital environment. Hence, DT should be understood from a holistic and multidisciplinary perspective, where new insights from technological and organizational approaches can be integrated (Anim-Yeboah *et al.*, 2020). Also, DT is a transdisciplinary and dispersed process, a phenomenon in constant construction where the social context determines the development conditions and their impacts (Maciag, 2018), and so an approach to the environment is also important.

Due to the complexity of DT (Vial, 2019), a new comprehension from alternative approaches is needed, thus allowing a better understanding of diverse factors that intervene in DT within organizations (Nadkarni & Prügl, 2020). Previous reviews have evidenced several factors and dimensions that are related to DT. However, it is necessary to apply new theoretical positions that allow us to expand our knowledge about this process of the digital age. Consequently, this article aims to comprehend DT from the theoretical lenses of the technological, organizational, and environmental (TOE) framework. To that end, a systematic literature review was conducted in order to identify the factors, drivers, and barriers of DT within TOE dimensions. In addition, the orientation of definition and research on DT will be analyzed from a TOE framework, which is a theoretical approach that will allow us to appreciate the integration required by DT with technology, organizational practices, and the analysis of the environment. Through this approach, it will be viable to appreciate the link between the TOE dimensions, so that DT could develop within business.

This paper is organized as follows. In the next section, we present the background of previous literature reviews on DT and the statements of the TOE framework before we detail the methodology applied in this review. Then, the relevant outcomes obtained through the TOE framework and a discussion of the results will be shown, reflecting on the factors that are present in DT and showing its definition according to our findings. Finally, we offer our conclusions and signal future research lines.

PREVIOUS LITERATURE REVIEWS ON DIGITAL TRANSFORMATION

Recent literature reviews reported the diversity of topics that DT can cover, where some of these highlight the multidisciplinary nature of DT, the importance of the process of value creation, its impact and scope, and the technology-actor link involved in this notion. Figure 1 summarizes the key contributions of literature reviews related to DT.

<p>Henriette et al., 2015 Code*: LR1</p> <p>A mapping of literature review. Classification of articles by digital capabilities, business model, user experience, and operational process.</p>	<p>Hausberg et al., 2019 Code: LR3</p> <p>An overview of the different disciplines of DT research from a holistic business perspective and clusters for research streams: Finance, marketing, innovation, knowledge management, analytics, manufacturing, supply chain, society, and tourism.</p>	<p>Nadkarni and Prügl, 2020 Code: LR5</p> <p>Mapping macro and micro-level observations. Two aggregate dimensions of DT: -Technology: the pace of change and time to market, technology capability and integration, consumer and other stakeholder interfaces, distributed value creation and capture, market environment, and rules of competition. -Actor: transformative leadership, managerial and organizational capabilities, company culture, work environment.</p>	<p>Hanelt et al., 2021 Code: LR6</p> <p>Multi-dimensional framework: contextual conditions, mechanisms, outcomes. Typology of perspectives on DT: technology impact, compartmentalized adaptation, systematic shift, and holistic co-evolution</p>	<p>Gong and Ribiere, 2021 Code: LR8</p> <p>Development of a unified definition of DT: pragmatic and academic analysis</p>
<p>Verhoef et al., 2019 Code: LR2</p> <p>External drivers of DT: digital technology, digital competition, digital customer behavior. Three stages of DT: digitization, digitalization, and digital transformation. Identification and delineation of digital resources, organizational structure, and growth strategies. Metrics for DT</p>	<p>Vial, 2019 Code: LR4</p> <p>It was built a framework to define DT: value creation, digital technologies, barriers to changing the value creation, and structural changes. It analyzed the impacts of DT on the organizational and social levels. Research agenda: role of digital capabilities and ethical issues.</p>		<p>Schneider and Kokshagina, 2021 Code: LR7</p> <p>Analysis of what we know and what we still need to learn about DT: the management of the transformation and implications for strategy and business models, customers and marketing, organization and governance, leadership, and employees.</p>	<p>Talafidaryani et al. 2021, 2019 Code: LR9</p> <p>Thematic views and issues related to DT: technological and industrial view, organizational and managerial view, a global and social view</p>

Figure 1. Main contributions of previous literature reviews on digital transformation. **Source:** authors.

It is worth mentioning that various authors have depicted DT from different angles. Henriette *et al.* (2015) and Schneider and Kokshagina (2021), for example, focus their attention on the organizational process, business models, and the customer as major components of DT. Verhoef *et al.* (2019) presented a wide view of the resources and metrics needed for DT, and the stages needed to get there. Hausberg *et al.* (2019) stated that research on DT has focused on the adoption or diffusion of technologies, business models, digitalization management, data management, logistics, and governance, with a greater interest in the consumer.

The literature reviews conducted by Vial (2019) and Gong and Ribiere (2021) provide a relation of the multiple definitions given to DT and address the impacts and strategic relationship of DT in organizations. These authors developed a definition of DT to add some clarity on this concept for researchers and practitioners.

The systematic literature review by Nadkarni and Prügl (2020) proposed the technology and actors as two main dimensions to understand DT, while the systematic literature review by Hanelt *et al.* (2021) provided a multi-dimensional framework to DT. The last argued that DT is driven and shaped mainly by

external factors, such as innovative technologies, so continuous change perspectives and theories of institutional diffusion might be immensely helpful to study this phenomenon. As a point of contrast, Talafidaryani *et al.* (2021) denote a global and social view to be considered in the DT process.

It is worth mentioning that the cited review studies adopted topic or content analysis to come up with their findings, with qualitative and inductive methods being extensively used. Gong and Ribiere (2021) and Schneider and Kokshagina (2021) also integrated the findings of the bibliographic search with expert interviews. To expand the comprehension of DT, researchers employed network (Talafidaryani *et al.*, 2021) and cluster analysis (Hausberg *et al.*, 2019). All of them identified various research opportunities in DT.

As observed, existing literature reviews have emphasized elements such as digital technology, technical capabilities, organizational culture, growth, and digital strategies, digital skills, business model, value creation, actors like employees, leaders, and customers, as well as external variables, such as market, global, and societal perspectives. Despite the previous contributions laying the groundwork for a deeper understanding of DT, further insights are required. Similarly, earlier reviews show that drivers and barriers have received little attention.

The TOE framework

Because of previous antecedents, as well as the wide range of internal and external factors that may impact the DT of companies (Díaz *et al.*, 2017), in this literature review, we suggest the application of the TOE framework for analyzing DT components, including barriers and drivers.

TOE framework “is an organization-level theory that explains that three different elements of a firm’s context adoption decisions” (Baker, 2012, p.2). It is related to models of adoption of innovation and diffusion of innovations that allows the analysis of organizational phenomena such as DT. As it can be seen in figure 2, the technological context or technological dimension includes all technologies, equipment, and technological methods that are currently used by the organization or those available in the market.

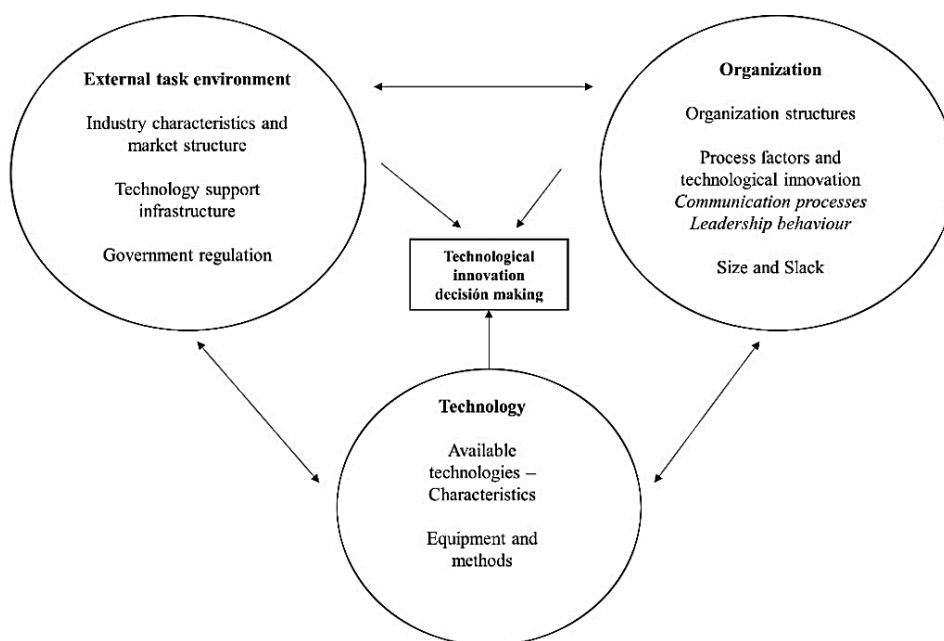


Figure 2. TOE framework. Source: adapted from Depietro *et al.* (1990).

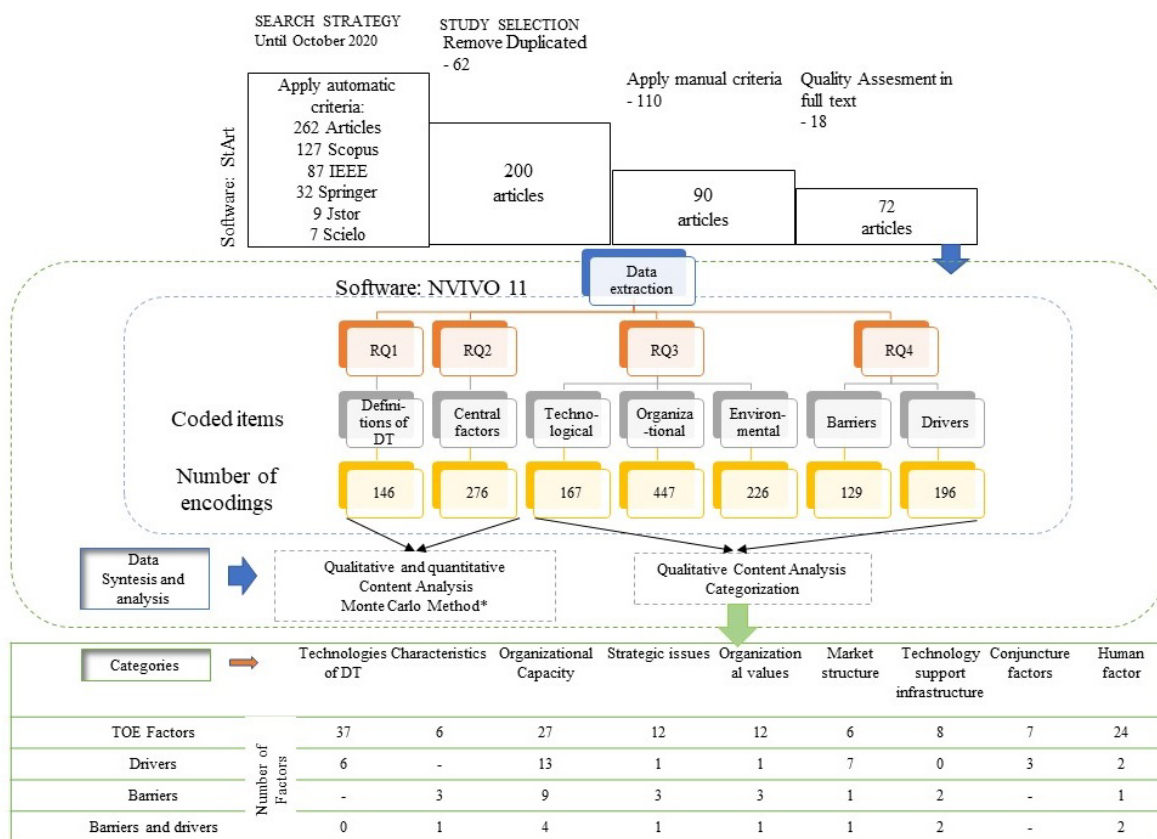
The organizational context or dimension encompasses all the characteristics of the organization, such as structures, resources, collaborators, size, and processes, among others. The environmental context or dimension refers to external factors or actors to the organization, stakeholders such as suppliers or customers, laws, or regulations concerning the general structure of the industry (Baker, 2012; Depietro *et al.*, 1990).

METHODOLOGY

Previous literature reviews showed the breadth of topics covered by DT, leading to considering the need for a systematic literature review that will integrate new factors. This paper is intended to provide a discussion with new perspectives based on the TOE framework. The following questions guided the systematic literature review: (RQ1) What is the TOE orientation in the definitions of DT? (RQ2) What is the TOE orientation in the literature covering DT? (RQ3) What are the technological, organizational, and environmental (TOE) factors involved in DT? (RQ4) What are the drivers and barriers to DT related to the TOE framework?

Literature review and analysis process

The literature review process suggested by Okoli and Schabram (2010) was used for conducting this research. The literature review process, as performed by the authors of this work, is shown in figure 3. Through this process, we established a protocol for a search strategy, search string, study selection, and quality assessment. In addition, we set up a protocol for data extraction and data synthesis and analysis.



*For analysis about TOE orientation in definition and central factors in literature of DT see Appendix A.

Figure 3. Literature review process. Source: authors.

Search strategy and the search string

Brings *et al.* (2018) state that the database search is the most efficient method with representative effectiveness to carry out a systematic literature review. Therefore, we used Scopus, IEEE, Springer, JSTOR, and SciELO databases as sources of information. Scopus is a relevant database that includes peer-review articles and it has been used in previous reviews about DT (Henriette *et al.*, 2015). IEEE database was employed because it is the most inclusive database for conference papers that are important to encompass a greater vision of the field. Springer is a database that could complement quality articles. JSTOR is an open-access database and SciELO contains Latin American sources, which are required for extra context perspectives.

The search string was used to find articles containing the keywords “digital transformation” in their title. This was applied to the five databases mentioned above. Synonyms of DT were not used in our literature search (e.g. digitization, digitalization) to prevent prejudice in our understanding and to focus our attention on articles that deal with DT as a fundamental theme (Gong & Ribiere, 2021).

Study selection

To select the appropriate articles, we applied automatic and manual criteria.

Automatic criteria

The results were filtered by areas such as management, information systems, technology management, data analysis, strategy, innovation, decision making, strategic planning, social and psychological aspects, among others, according to the options allowed by the databases in the business context. There was no publication year filter. The literature search was limited to open access articles since this enabled access to the full-text content. Only the Scopus database allowed the open access option to be selected. The other databases did not allow such an option, so articles whose full version could not be downloaded were removed.

Manual criteria

In this step, the criteria to determine which studies were to be included or excluded were defined. The inclusion criteria reinforced the search strategy. Thus, the inclusion criteria used in this study were based on i) a focus on articles written in English or Spanish, the languages that allow us a clear understanding; ii) articles whose abstracts show that the DT is the main topic; iii) articles that contribute with a micro-level focus, that is, those dealing with business or industries. This last criterion was considered given that the interest in the impact of DT at the business and management level has increased significantly (Schneider & Kokshagina, 2021).

The exclusion criteria were applied to avoid redundant information from other reviews and to focus on the customer as one of the principal pillars of DT (Henriette *et al.*, 2015). Thus, we excluded: i) literature review articles on DT; ii) papers that focus on electronic government, as in those cases the main user is a citizen; and iii) articles focusing on educational institutions, as the main user there are students.

The search and selection phase was performed using StArt software (LaPES, 2013).

Quality assessment

At this stage, the inclusion of articles that provide a high level of quality to the literature review was assured. Through a complete reading of the full text, we analyzed the rigor in structure and relevant

contribution of the papers selected for this study. The authors, in agreement, assessed each paper's contribution and structural rigor on a scale of 1 to 5 (1 = low; 5 = high). Articles with an average score lower than 3 were removed.

Data extraction and coding

We coded 72 articles (see appendix A) using NVivo 11 (Lumivero, 2023). After the supervision of a language professional, the coded sentences from the articles in Spanish were translated into English to be coded. Regarding the research questions, a preliminary coding was used: technological factors, organizational factors, environmental factors, barriers, drivers, and definition of DT. Our study took as a starting point the three TOE contexts, which guided us to identify the factors in these three main groups. Depietro et al. (1990) proposed a subclassification of factors that may exist in each context. However, this categorization was not considered in our study for the coding of factors as we built the categories inductively. Table 1 shows a summary of the guide used for the coding process.

Table 1.

Guide for data extraction and coding.

Unit	Description
Software	NVivo 11
Analysis unit	Article
Coding Strategy	RQ1. Structural coding was applied to select phrases and paragraphs to categorize the data corpus. In this case, the paragraph of definition was codified. The coding strategies were oriented by Saldaña (2009).
	RQ2, RQ3, RQ4. Descriptive coding was applied to get an inventory of each factor. In this case, only the words of the factor were codified.
Eligible factors to code	
	Definition of digital transformation
RQ1	Authors' definition or definitions to DT, as referenced or articulated by them in the introduction, discussion, or conclusions of the article.
RQ2	To answer this question, we coded the central factors studied by the authors and reported in the aim of the article.
RQ3	The main factors studied by the authors and reported in the objectives of the article, as well as the complementary factors concerning DT reported in the results and discussion sections of selected papers. A factor was considered as a fact, actor, or situation that appears in the DT scenarios (Pramanik et al., 2019).
Technological factors	Related to the technological context or dimension. In this study, we coded digital technology and its characteristics. Examples of coding: social media, software, augmented reality.
Organizational factors	Related to the organizational context or dimension. We coded characteristics of the organization such as structures, resources, collaborators, size, and processes, among others. Examples of coding: employees, digital skills, digital strategy.
Environmental factors	Related to the environmental context or dimension. We coded external factors or actors to the organization, stakeholders such as suppliers or customers, or regulations concerning the general structure of the industry. Examples of coding: customer, stakeholders, suppliers, culture, perspective, society, laws.
RQ4	Drivers and barriers related to DT were studied or mentioned explicitly by the authors in the results, discussion, or conclusions in the selected articles. The barriers and drivers were also classified according to the TOE framework.

Unit	Description
	We define a driver and a barrier based on Lesca <i>et al.</i> (2015).
Drivers	A driver is a factor that acts as a solution and promotes DT. Examples of coding: innovation, increasing profitability, transformative vision
Barriers	A barrier is a factor that negatively influences, slows, or hinders DT. Examples of coding: cultural issues, lack of collaboration, inertia

Source: authors (2021).

Data synthesis and analysis

In this study, the main focus of the analysis was of the qualitative type. As a complementary method, quantitative techniques were applied to analyze RQ1 and RQ2. The process is detailed according to the research questions.

RQ1 and RQ2

In the case of RQ1, word queries from NVivo were performed to highlight the words associated with the codified definitions. Then, the definitions coded in each article were analyzed as a whole through a qualitative content analysis strategy, following Bardin (2002) and Mayring (2014), in order to assign a TOE orientation for further analysis. The definitions oriented to digital technology or digitalization were classified as technological. The definitions related to organizational factors as a pivotal point of DT were classified as organizational. The definitions that are related to environmental factors as a central point of DT were classified as environmental. Besides, some definitions combined factors from two or more dimensions (see appendix A). Examples of definitions are shown in the results section.

The TOE orientation in the definitions of DT was analyzed through a quantitative analysis of the data with the Monte Carlo method (Loza *et al.*, 2018). This method allowed representing areas and intersections according to the number or frequency of coding units to calculate the area of each TOE dimension. That is, this method enabled us to appreciate the weight of each dimension TOE. The computation of the cumulative probabilities was necessary for this operation to calculate the surface area (see appendix B). The lowest error obtained after some repetitions were used to determine the ideal place for the graphic representation. This method was supported by software R.

In the case of RQ2, word queries and content analysis were also applied. To analyze the TOE orientation in the literature covering DT, the articles were classified according to the central factors reported in the aim of the article, similarly to what has been explained above. Then, the TOE orientation was analyzed through the Monte Carlo method (see appendix A and B).

RQ3 and RQ4

For data synthesis, word queries from NVivo allowed us to highlight the codified factors. This was useful to consolidate the repeated words, that is, synonyms were grouped like a factor. In the data analysis stage, the qualitative content analysis strategy was applied following Bardin (2002) and Mayring (2014). All factors were considered regardless of their coding frequency.

During the analysis of the coded factors, it was noted that some may occur at the intersection between two or three TOE dimensions. We identified factors that intersect the technological-organizational (TO) contexts, referring to the fact that it may develop the organization depending on what the technological context provides, or that this factor could come from a digital environment and is needed by the organization. A factor that intersects organizational-environmental (OE) contexts refers to

were grouped as a unit of analysis. The highest frequencies of words used to define DT can be observed in table 2. These frequencies give us a first global impression of the words that have built the concept of DT.

Table 2.

Frequency of words to define Digital Transformation.

Word	Frequency	Percentage
Technology	63	87.50
Business	47	65.28
Change	44	61.11
Process	39	54.17
Companies	22	30.56
Organization	20	27.78
Innovation	15	20.83
Model	15	20.83
Organizational	15	20.83
Products	14	19.44
Services	13	18.06
Strategy	12	16.67
Transformations	12	16.67

*Frequencies were taken from NVivo 11 and percentages calculated based on 72 articles examined in the literature review. Only words with frequencies greater than 15% were considered. **Source:** authors.

As can be noted, more than 50% of authors define DT through words such as technology, business model, change, and process. These words give us a first overview of DT as a process that requires changes at the technological level, around business models, and in the processes of an organization. However, words that guide a relationship with the environment are not highlighted.

The analysis of the TOE orientation is shown for a deeper examination of the definition of DT. The orientation of coded definitions was analyzed based on the TOE framework and the Monte Carlo method. Figure 5 illustrates an example of the coded definitions along with their TOE orientation.

Definition	TOE orientation	Article code*
Digital transformation changes societies and industries and is fueled by the convergence of social, mobile, cloud, and smart technologies as well as the growing need for automation and integration.	Technological	A17
Digital transformation is a complex and strategic activity that encompasses the entire organization.	Organizational	A18
Digital transformation refers to a broader process of transforming an organization or a network of organizations on different levels (e.g., strategy, governance, leadership, culture, people, technology, etc.) by making use of digital technologies and concepts, to which we refer to as enablers	Technological - Organizational	A26
Digital transformation is a process through which the practice-arrangement bundles of digital technologies evolve over time like a relational digital transformation where digital platforms and situational context act across the time	Technological-Environmental	A39
Digital transformation is a process that requires internal and external collaboration and relationships	Organizational-Environmental	A42
The modification (or adaptation) of business models, resulting from the dynamic pace of technological progress and innovation that trigger changes in consumer and social behaviors	Environmental	A37

Figure 5. Examples of coded definitions and their TOE orientation. *See article codes in appendix A. **Source:** authors.

Figure 6 shows the area of each technological, organizational, and environmental dimension and their intersections in definitions of DT. The concentration was obtained through the percentages corresponding to the classification in a TOE context based on statements of the Monte Carlo method (see appendix B).

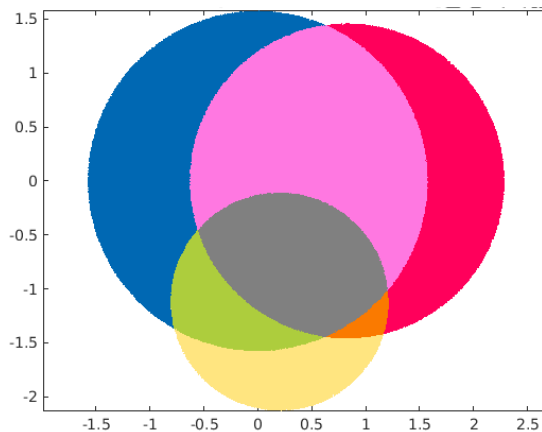


Figure 6. TOE orientation of the digital transformation definition. T = blue, O = red, E = yellow, TE = green, TO = pink, OE = orange, TOE = gray. **Source:** authors.

From these results it is possible to remark that i) most of the definitions of DT focus on technological issues; ii) the intersection of technological and organizational factors has received more attention; iii) an important part of the environmental factors has a place in definitions when the technological or organizational factor is present; iv) DT definitions have been poorly constructed along with environmental factors; and v) three TOE factors together have received less attention in the definition of DT.

TOE orientation in the literature covering digital transformation

This section shows the TOE orientation of DT from the central factors studied in the examined literature. This analysis clarifies how the extent of its factors in terms of technology, organization, or environment has been studied. The highest frequencies of central factors can be observed in table 3. These frequencies provide a first outlook of the data.

Table 3.

Frequency of words of central factors studied in the literature.

Central factor	Frequency	Percentage
Digitalization	33	45,8
Operations	27	37,5
Model	25	34,7
Process	24	33,3
Technology	22	30,6
Management	22	30,6
Business	20	27,8
Architecture	15	20,8
Value	12	16,7
Innovation	12	16,7

*Frequencies were taken from NVivo 11 and percentages calculated based on 72 articles examined in the literature review. Only words with frequencies greater than 15% were considered. **Source:** authors.

As can be noted, more than 30% of the literature has concentrated on factors related to digitalization, organizational operations, business models, process, technologies, and management. This data guides us to the fact that technological and organizational factors have been the center of attention

Most of the technological elements included digital technologies and attributes related to them. Regarding organizational elements, we identified factors such as organizational areas, company actors, qualities, skills, employees' attitude, tasks, practices, and objectives of a firm, among others. The environmental context included external and indirect actors to DT and events that companies cannot directly control. After reviewing the findings in each TOE dimension, we structured the distribution of factors, as depicted in figure 9.

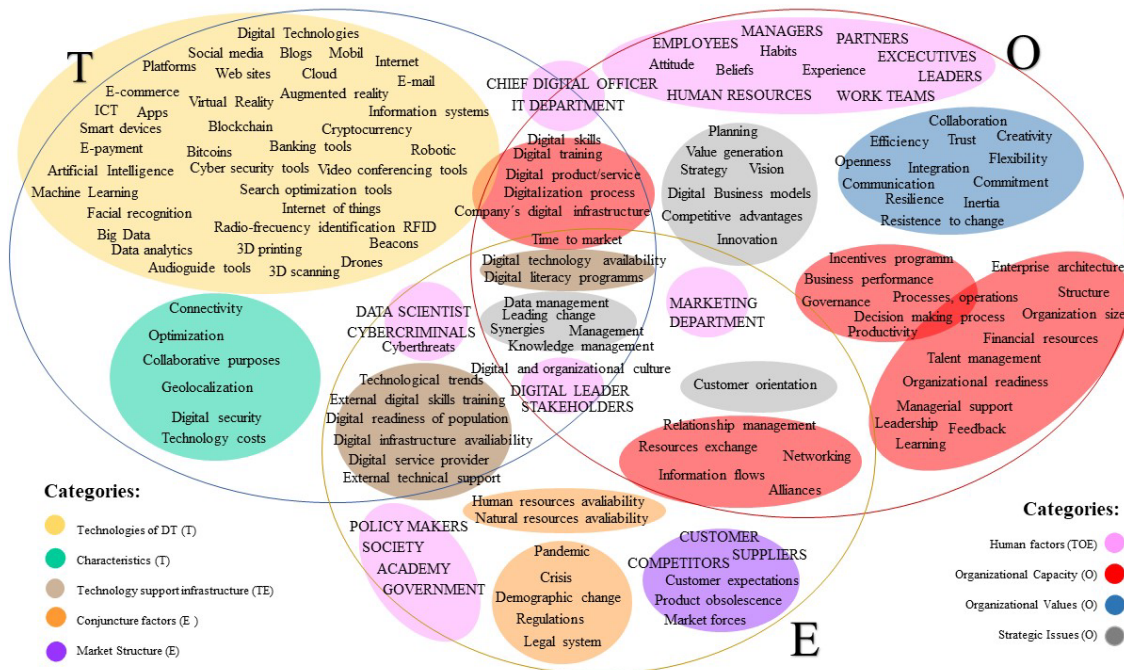


Figure 9. TOE factors in digital transformation. Source: authors.

Considering what has been explained above on the intersections, factors such as “culture” were placed at a TOE intersection, since this is a broad and complex concept that is present in all the three TOE dimensions, either as digital culture or organizational culture, which are formed from the general culture that human beings build from their environment. In the same way, “company’s digital infrastructure” was placed in a partial intersection TO as firms adapt their digital infrastructure according to what the technological context provides. Another partial intersection of OE, like “alliances,” refers to an organization’s need to relate to the environmental context for DT. This logic has been used to position each element in the intersections.

These factors have been grouped into categories. Our analysis emphasizes the categories listed in figure 10, where some are related to the categories proposed in preview literature reviews (see codes in figure 1). However, this study gives a different and wide representation of the elements and categories.

In this study, the “Technologies of DT” and “Organizational capacity” categories stand out for the largest number of factors they encompass. In addition, a concentration of “Human Factors” in the organizational context as well as in the TOE intersections can be observed. The “organizational values” are factors specifically identified in the organizational context, while “strategic issues” covers actions that intertwine the three TOE contexts. The “market structure” and “conjunction factors” are still very much a component of the environment. Finally, the “technology support infrastructure” category covers factors intertwined with technology and the environment. In addition, there are factors within this

category that must be analyzed from the organizational context, corroborating the interrelationship between TOE dimensions and categories.

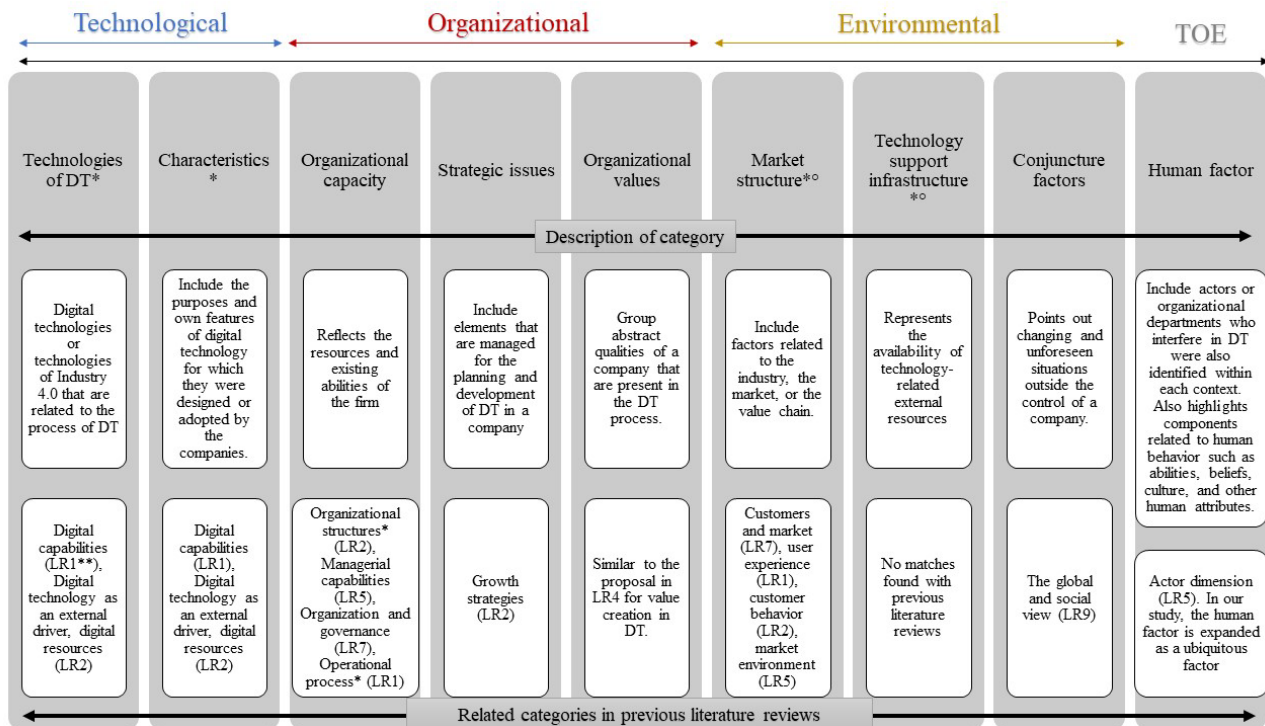


Figure 10. Categories inside TOE dimensions in digital transformation. °Categories that appear in TOE intersections. * Categories that correspond to the guidelines in the TOE framework proposed by Depietro *et al.* (1990). **See the codes of literature reviews in figure 1. **Source:** authors.

Drivers and barriers of the TOE framework

In this section, we will show drivers and barriers related to DT that were studied or mentioned explicitly in the selected articles studied. A word query with synonyms words in NVivo 11 allowed us to recognize the factors. A first joint impression of the encoded barriers and drivers can be seen in figure 11.



Figure 11. Word cloud of coded drivers and barriers. **Source:** authors, using NVivo 11.

The synonyms were grouped like a factor, and these were classified in a TOE context with the same categories defined above, as observed in figure 12. Some factors were mentioned both as a barrier and a driver.

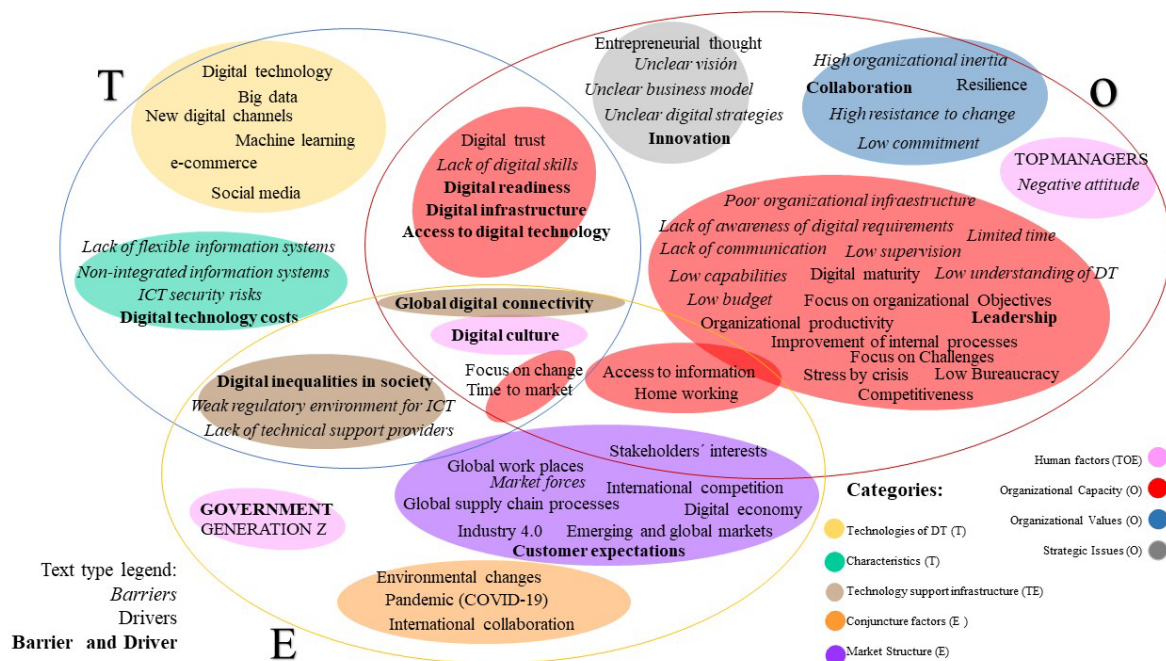


Figure 12. Drivers and barriers (TOE) in digital transformation. Source: authors.

In the technological context, our findings show digital technologies as a driver and some characteristics as a barrier when they are related to the flexibility of information systems and security. The “digital technology costs” variable has been identified as a driver and a barrier. It was mentioned as a barrier when the organization cannot transform digitally because of the excessive cost of digital technology implementation (e.g., A71 – see codes in appendix A). It was also considered a driver when the market prices of digital technology are affordable for organizations and allow them to reduce costs (e.g., A65).

Regarding the organizational dimension, the category “organizational capacity” concentrates on both barriers and drivers. The main barriers are focused on organizational weaknesses, such as a low budget (e.g., A49) or lack of communication (e.g., A67). The drivers show actions and characteristics in the companies that allow the development of the DT, as in the case of a company’s digital maturity (e.g., A3). Leadership has been identified as a driver when companies stimulate this ability, and as a barrier when they have not strengthened it (e.g., A34, A57). It can be noted that the category “strategic issues” concentrates on barriers such as a lack of a business model, digital strategies, and an unclear vision (e.g., A23), while entrepreneurial thinking is a driver to be highlighted. The category “organizational values” points out barriers such as resistance to change, low commitment and inertia, and drivers such as resilience (e.g., A51). Inside this category, the factor of collaboration has been identified both as a barrier and a driver.

The environmental context mainly signals the “market structure” and “conjuncture factors” as drivers. Customer expectations and market forces could also be identified as a barrier. This dichotomy was emphasized in a setting that stressed how quickly a customer needs change, giving a business both

possibilities and threats to satisfy them in a competitive environment. For example, “customer expectations” was mentioned as an impediment to DT because of its fast-changing demand, for which not all companies might be prepared (e.g., A60), and as a driver because these lead companies to adopt new digital technologies (e.g., A24). In this study, few actors could be identified, so the category “human factor” is scarce. In this category, it can be noted that the top managers and Gen Z individuals are the key drivers behind DT (e.g. A8). The government has been reported as a barrier and a driver for DT within companies (e.g., A32, A53). Finally, the category “technology support infrastructure” concentrates on barriers related to problems in the regulatory aspect of digital technology, connectivity, and technology providers. All results described in this section will be discussed below.

DISCUSSION

The outcomes of the present review indicate a TOE orientation in the definitions of DT and the existing literature covering this area of study. Additionally, this review showed the scope of the factors implicated in DT, their barriers, and drivers. Following this, we will present a discussion based on the research questions proposed above.

RQ1. What is the TOE orientation in the definitions of DT?

Two earlier studies were interested in defining DT. On the one hand, Vial (2019) defined DT by highlighting the active role of digital technology and the need to channel strategies and value creation. Vial’s work also indicates that the process will have a positive or negative impact depending on the structural changes and the management of organizational barriers as part of its definition. On the other hand, Gong and Ribiere (2021) defined DT as a process of change that is driven by innovation in digital technologies leveraged in the strategic use of the resources and capabilities of the organization. These authors also point out that the purpose of DT is to improve the value proposition for stakeholders, thus indicating the importance of human resources for DT. These two definitions allow us to consider the key role of digital technology, strategies, and organizational capabilities in DT and relate their impact to an external environment. However, such an external environment is not only part of its impact but of its continuous process as well.

In our study, it was possible to show that the most representative elements to define DT are technology, organization, and change. In addition, the analysis of the TOE orientation allowed an approach of the balance of its components. This orientation suggests that most of the technological and organizational factors are those that define DT, and the elements of the environment are scarcely considered to define the DT phenomenon. These results suggest that DT is a hybrid process between technology and organizational practices. Similar to Kane's proposal (2019b), DT is not only about technology but also about the people behind; in other words, the technological factor cannot survive without the organizational factor, being the later strongly dependent on the human factor.

Nevertheless, the environmental components should be more prominent when defining DT, which should balance the technological, organizational, and environmental components since they are dimensions that transcend one over the other. DT will take place in an organization when human and organizational factors connect practices to take advantage of digital technology, considering market structures and the global situation of the business context in order to create value.

In brief, DT involves digital technology, the human factor that integrates all technological, organizational and environmental contexts, and the external interests and expectations that are required to manage DT in a company. DT could also be considered a complex phenomenon in constant construction, as suggested by Maciag (2018), or a cycle that begins but does not finish, that is in continuous improvement, as proposed by Rosing and Etzel (2020). Thus, over our findings, a broader scope is required to understand what digital transformation is. Because of this, to encompass the global context of DT and complement the definitions proposed by Gong and Ribiere (2021) and Vial (2019), a TOE definition is proposed below. Our entire discussion is guided by this perspective on DT:

Digital transformation is an integral and continuous organizational process. DT requires the management of technological, organizational, and environmental factors to take advantage of digital technology and create value for the organization and its stakeholders, within a changing digital environment.

RQ2. What is the TOE orientation in the literature covering DT?

Previous reviews have not analyzed the TOE orientation of the literature covering DT. Singularly, Talafidaryani *et al.* (2021) delivered a prior vision of the technological, organizational, and social topics that have been studied in DT. In our review, an analysis of the TOE orientation in the literature on DT has been performed with the aim of providing an overview of the balance of factors that have been of interest in the study of DT. As noted, research has oriented its attention on the combined study of technological and organizational factors. This invites us to suggest that the study of DT has inquired mostly about organizational practices focused on digital technologies, where environmental factors are scarcely considered; similar to what we noted on the definition of DT.

This orientation could be diverting the full understanding of DT. As expressed, our findings demonstrate the need to carry out research studies with other comprehensive and holistic positions, since DT is a complex phenomenon that must be studied from various angles that complement its interpretation. If environmental factors are not considered in future research on DT, we will not be able to know its scope concerning the impact of the situation, technological progress of nations, digital gaps in society, requirements, and impact of DT on new generations. Likewise, the factors of the three TOE dimensions must be considered integrally to study the DT. For example, this could help to understand how to carry out the DT according to the characteristics and nature of the organization, the availability of digital technology, and the scope of a region's technology policy. Thus, several elements from the three TOE dimensions could be merged for future studies.

RQ3. What are the technological, organizational, and environmental factors involved in DT?

Previous literature reviews have already noted the multidisciplinary quality of DT and the diversity of factors that may be related to it. These review works have implicitly exposed and fostered reflections on the link of DT with a range of factors at a technological, organizational, and environmental level. For example, Henriette *et al.* (2015) highlighted the link between organizational factors such as digital capabilities, business models and operational processes with the need to connect users' experience in the transformation process as an external factor. Schneider and Kokshagina (2021) and Verhoef *et al.* (2019) have emphasized how DT's growth strategies take into account the customers and their environment. In turn, Vial (2019) has underlined the value creation from structural changes for companies' DT. Nadkarni and Prüggl (2020) have foregrounded the technological dimension by integrating it with market factors, and they have highlighted those related to transformation as managers, leaders,

and collaborators as the main actor in DT. Finally, Talafidaryani *et al.* (2021) have offered a vision of DT from technological-industrial, organizational-managerial, and social components.

It should be emphasized that several factors have also been examined separately in earlier studies related to DT. According to the technological context, there is substantial work that directs the functionality of digital technologies and digital maturity (Gudergan *et al.*, 2019; Ifenthaler & Egloffstein, 2020). Regarding organizational context, the human factor has been treated with a special interest, as in the case of the role of leaders and chief digital officers (Engesmo & Panteli, 2019), managerial capabilities (Anim-Yeboah *et al.*, 2020), and employees' attitude (Meske, 2019). Besides, there has been a recurrent interest in organizational structure and strategic issues (Merchán & Paliz, 2019). Concerning the environmental context, culture (Mergel *et al.*, 2019) and stakeholders (Shafiee *et al.*, 2019) have been the principal topics addressed.

In our study, in addition to a TOE view of the factors, the categories related to each dimension have also been highlighted. The technological dimension involves the digital technologies and their characteristics; the organizational context entails the organizational capacity, strategic issues, and organizational values; and the environmental context implies conjuncture factors, market structure, and technology support infrastructure. As we have detailed in previous sections, some categories are similar to those proposed in previous studies by other authors. However, in our study, the organizational values, and strategic issues that organizations consider in the DT process have been emphasized separately from their capacity. Likewise, we have remarked on a group of conjunctural factors, since these have significantly impacted digital changes in recent years at the organizational level in various regions of the world. Moreover, the environmental categories presented in this study allow identifying that DT's application extends far beyond the customer. That is, it expands to the social, economic, and political reality.

Our study has also established a particular emphasis on factors related to digital technology and organizational capabilities. This coincides with what was found in the TOE orientation towards DT definition and the literature covering this subject. This repetitive finding could suggest a strong link between the technological part of DT and the human ability in the organization to exploit its scope. More significantly, the ubiquitousness of the human factor in all the three dimensions has been brought to light. The human being is part of the creation and construction of its technological environment, its development in organizational capacities and strategies, and its market situation and structure. So, the action by the human factor is what enables firms to manage and adopt technology for DT.

An important human factor to mention is culture, which is a human quality that acts as an integral TOE factor of DT that has hardly been studied with a comprehensive approach. Hence, an integrated approach could make it possible to understand the impact of culture on DT, linking this element to the digital, organizational, and entire cultural context.

RQ4. What are the drivers and barriers to DT regarding the TOE framework?

Previous works have given way to reflection on the barriers and drivers within the DT process. For example, Verhoef *et al.* (2019) have proposed that external drivers to DT are the existence of digital technology, digital competences, and digital customer behavior. On the other hand, Vial (2019) has highlighted that inertia and organizational resistance must be analyzed as important barriers in the DT process. A TOE approach and description of some factors were done by Van Dyk and Van Belle (2019). In their study, these authors qualitatively qualified technological, organizational, and environmental

factors as positive (drivers) or negative (barriers), according to the perceptions of retail managers. Several factors were shown as both drivers and barriers depending on their scarcity or impact on this particular industry.

In our study, the drivers and barriers have been classified among the TOE dimensions and, therefore, we proposed a categorization based on the categories allocated to the TOE factors identified in our results. This categorization provides an overview of factors that may be applied as a reference in various industries. Within the organizational context, it can be highlighted that organizational capabilities was the category that showed a concentration of both barriers and drivers. These results guide us in examining how companies should intensify their internal management of these factors to enhance their DT through the improvement of their digital capabilities and the knowledge and leadership of their employees.

Similarly, it is important to focus on the organizational goals and manage their digital preparation through access to key infrastructure and information assets for this process. Companies must develop capabilities that allow them to be focused on change and respond effectively to market needs. In addition, these actions might be joined to the management of technological availability that occurs in a specific context. Organizational barriers have been found concentrated in strategic issues, where organizations show weaknesses in their DT planning process and their business model. Other barriers are concentrated in organizational values, where inertia and resistance to change inhibit DT, as proposed by Vial (2019). This, once again, reinforces the need for a comprehensive analysis of TOE contexts, which allows a balance between the different actions for DT in organizations.

Moreover, the technological dimension shows DT technologies as drivers of this process, where Big Data, e-commerce, machine learning, and social media innovations stand out as the main actors. This would indicate the growing interest in these technologies from various industries, as Hausberg *et al.* (2019) point out. Consequently, firms have allocated more activities to respond to the digital age and be at the forefront of modern technologies.

In the environment dimension, it is interesting to note that the category of market structure and conjunctural factors show the most drivers for DT. Regarding market structure, companies might focus on new market trends, emerging markets, and new ways of working that the digital age has developed. Also, they may consider the new demands of Industry 4.0 and the permanence of a digital economy to restructure its operations by adapting them to new virtual environments.

Regarding the conjuncture factors, we can highlight a tangible and recent example with the COVID-19 pandemic, which, despite its negative impact on some economic sectors, encouraged businesses to renew their procedures by going digital. This may indicate that businesses will largely benefit from environmental changes, in this case, as a result of a forced improvement and adaptation process. On the other hand, the category of infrastructure support reinforces our judgment that DT will be a challenging process to deal with as long as there is no viable regulatory framework and the closing of digital gaps in society.

As mentioned in the results section, the human factor has not been widely identified within the barriers and drivers for DT. However, it is important to call attention to the role of managers, the government, and new generations, since these are factors to be considered significant in DT. Managers are the ones who lead improvement actions. Therefore, if they do not intervene in the DT process, companies will not take the right course to maximize its opportunities and develop capabilities.

Governments are also a key factor in the DT process. These actors have played a role both as a barrier and a driver for DT. Undoubtedly, the DT of organizations requires government support to access the benefits of the digital age and lead training tasks, continuous improvement, and skills development that will allow resilience within organizations. These findings seem to be consistent with the actions that governments should take to manage digital technology in a competitive way for a nation (Arredondo *et al.*, 2020; Vial, 2019), where new generations are the engine for companies to innovate. From now on, new generations will undoubtedly be digital natives, whose permanent and strong link with digital technology will give way to new needs and challenges for organizations. The barriers and drivers for DT remain uncertain due to the different circumstances of each industry and country. Therefore, these results could generate new interpretations depending on the context and industry that confronts them.

As a final point of this discussion, it is important to highlight that our study has shown that the integration between the technological, organizational, and environmental factors is unavoidable, that is, no factor or TOE dimension could be analyzed separately, as each one depends on the other to create a DT process. As a result of the findings and analysis in our study, we suggest companies bear in mind three management actions that balance the TOE dimensions in the DT process, which might link the TOE contexts and manage the factors related to DT in organizations (figure 13). These actions are explained below:

Management of digital technology and organizational capacities: It is an action to consider the participation of the IT department, the chief digital officer, and the digital leader to develop human, financial, and infrastructure capacities in the company to take advantage of the existing technological offer.

Management of collaborative networks and external relationships: It is a necessary action to consider relational tasks or relational orientation to reach alliances and resources coming from the environmental context.

Management of technological policies: It is an action that organizations should consider at a macro level. Companies should know and adopt policies for their needs and requirements to facilitate the benefits of technological and environmental contexts.

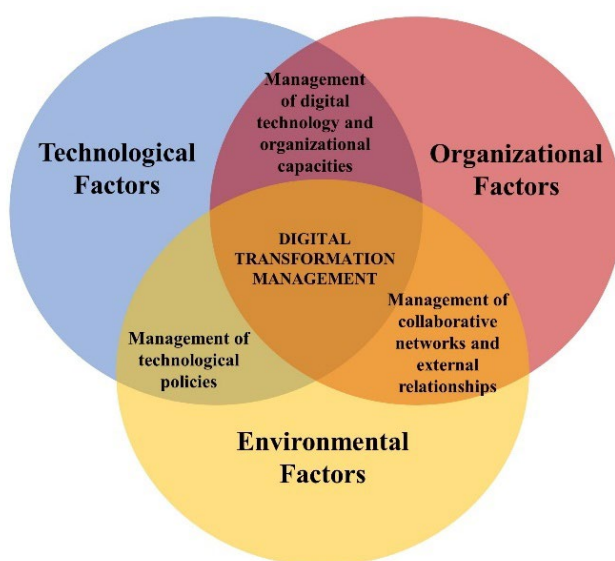


Figure 13. Management actions to digital transformation. **Source:** authors.

These actions might also be considered key to managing the factors acting as drivers or barriers that organizations could face during the DT process. These drivers and barriers could be born from the environment, the technology, or internally in organizations. However, if organizational practices are focused in managing digital technology, public policies, and external relations, the opportunities that could be exploited by an organization as well as the potential obstacles it might overcome to transform digitally could be more clearly identified.

CONCLUSIONS, LIMITATIONS, AND FUTURE RESEARCH LINES

This study aimed to comprehend DT from the theoretical lenses of the technological, organizational, and environmental (TOE) framework. A systematic literature review was conducted in order to identify the factors, drivers, and barriers for DT within the TOE dimensions. In addition, the orientation of the definitions and available studies on DT were analyzed under the TOE approach. Our findings allowed us to appreciate the integration required by DT with technology, organizational practices, and environmental factors. It was also possible to acknowledge the link between the TOE dimensions for DT development in companies.

After the proposed research questions, several findings could be obtained. First, the factors and their categorization within each TOE dimension reveal that organizational capabilities and digital technologies are the factors that have been most usually related to DT. Second, barriers and drivers for DT were identified, noting a concentration of these elements in organizational capacities. The organizational goal of achieving the benefits of the digital age could be the summary of the drivers required to transform digitally. This paper has also highlighted that the conjuncture factors have been described more as promoters than obstacles for DT.

The words that have been most frequently used to define DT were appreciated in this paper, as well as the TOE orientation that featured that such definition has concentrated on technological and organizational factors. This finding allowed proposing a more balanced definition that integrates the conception of the environment. Additionally, TOE orientation in the literature on DT was presented, revealing that the most studied factors are intersected in the technological-organizational dimension, which calls for the integration of environmental factors to fully understand DT.

The study of the environment could help understand how companies are digitally transformed according to their social and political context, that allow or not to provide digital infrastructure to nations, and their cultural reality, which influences the organizational and digital culture. Likewise, an approach to an environment-related perspective enables a better comprehension on how to exploit present issues to adjust to future digital realities and, furthermore, to anticipate future requirements by new generations, markets, and economic structures.

The TOE framework gave a new theoretical orientation to understanding DT. Although previous studies have already adopted this approach for specific industries, this research showed that it can be an analytical basis for studying DT in various industrial domains. Undoubtedly, the factors could be highlighted according to the business area and based on the context in which the companies implement their DT. Likewise, this study reinforced the categories proposed in previous reviews, and offered a visualization of the associated factors, highlighting the human factor as a category that should be transversal to all TOE dimensions.

At a practical level, our analysis provides a basis for the managers responsible for the DT of the companies they represent. Above all, the management actions proposed in this study could be useful for organizations to guide key strategies for successful DT. Managers should understand that DT is a continuous process, considering the constant evolution of digital reality. In addition, DT is a process that should be developed and linked to the organization and its technological reality at a macro level, as well as to the firm's context reality. The digital leader might meet new market requirements, but at the same time, he/she should strengthen the digital skills of employees and the digital infrastructure. Furthermore, the development of values and organizational strategies that will enhance digital practices becomes an important input. Organizations should not isolate themselves from the development of public policies for DT, since maximizing business opportunities and overcoming the obstacles in this process depend on DT.

This study is not without limitations. One of the threats to validity in systematic literature reviews are biases that could emerge in the process of selecting, reviewing, and analyzing the literature. To minimize this risk, the research team took different actions to avoid these threats. The decisions regarding the construction of the search string, selection of databases, application of criteria, and analysis of the quality of the articles, were taken during meetings where the authors discussed positions and opinions to reach an agreement. Past reviews were also analyzed in order to have a basis for the development of this study. The coding and categorization of results was a process that underwent a verification stage by the authors, comparing previous findings and consolidating opinions in the classification and categories proposed in this study. The process of TOE orientation analysis was also carried out with the unified agreement of the authors. Throughout the process, several meetings allowed the evaluation of each phase with pilot articles.

Future research might replicate this review with new databases and quantitative methods, contrasting the factors and TOE orientation suggested in this study. Our findings suggest that future studies should broaden the understanding of DT by balancing the technological, organizational, and environmental dimensions. Likewise, studies that allow the analysis of the specific impact of various social factors, market structures, consumption trends, the creation of collaborative networks, and public policy management for DT should be conducted. The extent to which the management strategies suggested in this study are implemented by companies for the development of DT might be statistically addressed in future studies.

DISCLOSURES

The authors declare no institutional or personal conflicts of interest.

REFERENCES

- Anim-Yeboah, S., Boateng, R., Odoom, R., & Kolog, E. (2020). Digital transformation process and the capability and capacity implications for small and medium enterprises. *International Journal of E-Entrepreneurship and Innovation*, 10(2), 26-44. <https://doi.org/10.4018/IJEEI.2020070102>
- Arredondo, F., Vázquez, J., & Guerra, E. (2020). Information and communication technologies and their impact on competitiveness in Latin America. *Journal of Technology Management and Innovation*, 15(4),

- 43-53. <https://doi.org/10.4067/s0718-27242020000400043>
- Baker, J. (2012). The Technology-Organization-Environment Framework. In Y. K. Dwivedi, M. R. Wade, & S. L. Schneberger (Eds.), *Information Systems theory* (pp. 231-245). <https://doi.org/10.1007/978-1-4419-6108-2>
- Bardin, L. (2002). *El análisis de contenido*. Ediciones Akal.
- Brings, J., Daun, M., Kempe, M., & Weyer, T. (2018). On different search methods for systematic literature reviews and maps. *EASE´18*, 1-11. <https://doi.org/10.1145/3210459.3210463>
- Correa, M., & Díaz, B. (2018). Capacidad en tecnologías de información y desempeño organizacional: un estudio en el contexto colombiano. *Innovar*, 28(69), 99-116. <https://doi.org/10.15446/innovar.v28n69.71699>
- Depietro, R., Wiarda, E., & Fleischer, M. (1990). The context for change: Organization, technology and environment. In L. Tornatzky & M. Fleischer (Eds.), *The processes of technological innovation* (259-290). Lexington Books. https://openlibrary.org/books/OL2207473M/The_processes_of_technological_innovation
- Díaz, B., Gómez, J., García, J., Melo, H., & Sanabria, F. (2017). Contribución de las iniciativas de tecnologías de la información en las organizaciones: una revisión de literatura. *Innovar*, 27(66), 41-55. <https://doi.org/https://doi.org/10.15446/innovar.v27n66.66710>.
- Engesmo, J., & Panteli, N. (2019). Chief digital officers as protagonists in digital transformation. *Conference on E-Business, e-Services and e-Society*, 730-737. https://doi.org/https://doi.org/10.1007/978-3-030-29374-1_59
- Fitzgerald, M., Kruschwitz, N., Bonnet, D., & Welch, M. (2014). Embracing digital technology: A new strategic imperative. *MIT Sloan Management Review*, 55(2), 1-12. <https://sloanreview.mit.edu/projects/embracing-digital-technology/>
- Fodranová, I. (2021). How can digital sharing economy reduce unemployment? *Journal of Technology Management and Innovation*, 16(1), 51-57. <https://doi.org/http://dx.doi.org/10.4067/S0718-27242021000100051>
- Gong, C., & Ribiere, V. (2021). Developing a unified definition of digital transformation. *Technovation*, 102(102217), 1-17. <https://doi.org/https://doi.org/10.1016/j.technovation.2020.102217>
- Gudergan, G., Kwiatkowski, A., & Krechting, D. (2019). Patterns of digitization – What differentiates digitally mature organizations ? *IEEE International Conference on Engineering, Technology and Innovation (ICE/ITMC)*, 1-8. <https://ieeexplore.ieee.org/abstract/document/8792585>
- Hanelt, A., Bohnsack, R., Marz, D., & Antunes, C. (2021). A systematic review of the literature on digital transformation: Insights and implications for strategy and organizational change. *Journal of Management Studies*, 58(5), 1159-1197. <https://doi.org/doi:10.1111/joms.12639>
- Hausberg, P., Liere, K., Packmohr, S., Pakura, S., & Vogelsang, K. (2019). Research streams on digital transformation from a holistic business perspective: A systematic literature review and citation network analysis. *Journal of Business Economics*, 89, 931-963. <https://doi.org/10.1007/s11573-019-00956-z>
- Henriette, E., Feki, M., & Boughzala, I. (2015). The shape of digital transformation: A systematic literature review. *Information Systems in a Changing Economy and Society: MCIS2015 Proceedings*, 431-443. <https://aisel.aisnet.org/cgi/viewcontent.cgi?article=1038&context=mcis2015#page=438>
- Hildebrandt, J., Kluge, J., & Ziefle, M. (2019). Work in progress: Barriers and concerns of elderly workers towards the digital transformation of work. *International Conference on Human-Computer Interaction, Julio*, 158-169. <https://doi.org/10.1007/978-3-030-22012-9>
- Ifenthaler, D., & Egloffstein, M. (2020). Development and Implementation of a maturity model of

- digital transformation. *TechTrends*, 64(2), 302-309. <https://doi.org/10.1007/s11528-019-00457-4>
- Kane, G. (2019, July 22). Transformation without Technology. *MIT Sloan Management Review*. <https://sloanreview.mit.edu/article/transformation-without-technology/>
- Klein, V., & Todesco, J. (2021). COVID-19 crisis and SMEs responses: The role of digital transformation. *Knowledge and Process Management*, 28(2), 117-133. <https://doi.org/10.1002/kpm.1660>
- Koilada, K. (2019). Value-based digital transformation: Innovating customer experiences. 2019 *IEEE Technology & Engineering Management Conference (TEMSCON)*, June, 1-5. IEEE. 10.1109/TEMSCON.2019.8813559
- LaPES. (2013). *StArt. State of the Art through Systematic Review*. <https://www.lapes.ufscar.br/resources/tools-1/start-1>
- Lesca, N., Caron, M., Loza, E., & Chalus, M. (2015). Drivers and barriers to pre-adoption of strategic scanning information systems in the context of sustainable supply chain. *Systèmes d'information & Management*, 20(3), 9. <https://doi.org/10.3917/sim.153.0009>
- Loza, E., Segura, M., Roa, H., & Montenegro, C. (2018). Unveiling unbalance on sustainable supply chain research: Did we forget something? In A. Rocha & T. Guarda (Eds.), *Proceedings of the International Conference on Information Technology & Systems (ICITS 2018)* (pp. 264-274). https://doi.org/https://doi.org/10.1007/978-3-319-73450-7_26
- Lumivero. (2023). Data analysis software for academic research NVivo <https://lumivero.com/products/nvivo/>
- Maciag, R. (2018). Digital transformation as the subject of discursive analysis. *IEEE 16th International Conference on Industrial Informatics. INDIN 2018*, 1065-1070. <https://doi.org/10.1109/INDIN.2018.8471991>
- Mayring, P. (2014). *Qualitative content analysis: Theoretical foundation, basic procedures and software solution*. <https://nbn-resolving.org/urn:nbn:de:0168-ssoar-395173>
- Merchán, V., & Paliz, V. (2019). Enterprise digital transformation in Ecuador: Strategic Options. *International Conference on Applied Technologies*, 179-190. https://doi.org/https://doi.org/10.1007/978-3-030-42517-3_14
- Mergel, I., Edelmann, N., & Haug, N. (2019). Defining digital transformation: Results from expert interviews. *Government Information Quarterly*, 36(4), 101385. <https://doi.org/10.1016/j.giq.2019.06.002>
- Meske, C. (2019). Digital workplace transformation - On the role of self-determination in the context of transforming work environments. *27th European Conference on Information Systems - Information Systems for a Sharing Society*, 1-18. https://aisel.aisnet.org/ecis2019_rp/44
- Nadkarni, S., & Prügl, R. (2020). Digital transformation: A review, synthesis and opportunities for future research. *Management Review Quarterly*, 71, 233-431. <https://doi.org/10.1007/s11301-020-00185-7>
- Okoli, C., & Schabram, K. (2010). A guide to conducting a systematic literature review of information systems research. *Sprouts: Working Papers on Information Systems*, 10(26), <http://dx.doi.org/10.2139/ssrn.1954824>
- Pani, A., & Pramanik, H. (2020). Digital Transformation of organizations - Defining an emergent construct. In S. Sharma, Y. Dwivedi, B. Metri, & N. Rana (Eds.), *International Conference on Transfer and Diffusion of IT* (pp. 511-523). https://doi.org/10.1007/978-3-030-64861-9_45
- Pramanik, H., Kirtania, M., & Pani, A. (2019). Essence of digital transformation—Manifestations at large financial institutions from North America. *Future Generation Computer Systems*, 95, 323-343. <https://doi.org/10.1016/j.future.2018.12.003>
- Rosing, M., & Etzel, G. (2020). Introduction to the digital transformation lifecycle. *CEUR Workshop*

- Proceedings, 92-99. <https://www.leadingpractice.com/wp-content/uploads/2020/03/Introduction-to-The-Digital-Transformation-Lifecycle.pdf>
- Saldaña, J. (2009). *The Coding Manual for Qualitative Researchers*. Sage
- Schneider, S., & Kokshagina, O. (2021). Digital transformation: What we have learned (thus far) and what is next. *Creativity and Innovation Management*, 30(2), 384-411. <https://doi.org/DOI:10.1111/caim.12414>
- Shafiee, S., Shafiee, S., Shafiee, M., & Hvam, L. (2019). Challenges of digital transformation: The case of the non-profit sector. *IEEE International Conference on Industrial Engineering and Engineering Management*. <https://doi.org/10.1109/IEEM.2018.8607762>
- Talafidaryani, M., Jalali, S., & Moro, S. (2021). Digital transformation: Toward new research themes and collaborations yet to be explored. *Business Information Review*, 38(10), 79-88. <https://doi.org/DOI:10.1177/0266382120986035>
- Van Dyk, R., & Van Belle, J. (2019). Drivers and challenges for digital transformation in the South African retail industry. In E. Z. Ed (Ed.), *Information Technology for Management: Current Research and Future Directions* (pp. 42-62). <https://doi.org/10.1007/978-3-030-43353-6>
- Verhoef, P., Broekhuizen, T., Bart, Y., Bhattacharya, A., Qi Dong, J., Fabian, N., & Haenlein, M. (2019). Digital transformation: A multidisciplinary reflection and research agenda. *Journal of Business Research*, 122, 889-901. <https://doi.org/10.1016/j.jbusres.2019.09.022>
- Vial, G. (2019). Understanding digital transformation: A review and a research agenda. *Journal of Strategic Information Systems*, 28(2), 118-144. <https://doi.org/https://doi.org/10.1016/j.jsis.2019.01.003>
- Westerman, G., & Bonnet, D. (2015, February 15). Revamping your business through digital transformation. *MIT Sloan Management Review*, 10-13. https://sloanreview.mit.edu/article/revamping-your-business-through-digital-transformation/?gclid=CjwKCAjw7J6EBhBDEiwA5UUM2jWsOuWN4GgELKKoiMj_nvKYSXxaQk31mblrwTik31Zi2r2gxPYn6xoCi5gQAvD_BwE