

Digital Transformation: A Review and Research Framework

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Abstract: Extant literature has increased our understanding of specific aspects of digital transformation, but we lack a comprehensive portrait of its nature and implications. Through a review of works at home and abroad, we conclude the meaning of digital transformation from the technical and value dimensions, and then elaborate the concept of digital transformation from the perspective of the strategic change process. The TOE framework is used to analyze the impact of relevant factors on digital transformation in three dimensions: technology, organization and environment. We inductively build a framework of digital transformation basing on the analysis of the connotations and theoretical perspectives of digital transformation. Finally, taking into account the shortcomings of the existing digital transformation literature, we propose relevant research directions on digital transformation.

Keywords: Digital transformation, Digitalization, Strategic transformation, Corporate strategy.

1. Introduction

Data is the oil of the future society and the new driving force of economic and social development. The Fourth Plenary Session of the 19th CPC Central Committee recognized data as the seventh factor of production after labor, capital, land, knowledge, technology and management. With the rapid development of digital economy with data as the main factor of production, digitalization has become an inevitable choice for countries around the world to transform their growth drivers, and more and more enterprises have opened the road of digital transformation. World-famous leading enterprises such as Apple, General Motors, Microsoft, etc. have seized the major opportunities brought by the digital economy and carried out a comprehensive digital transformation of the enterprise value chain, covering R&D, management, procurement, production, marketing, logistics and after-sales service, which has powerfully driven the rapid expansion of enterprise business and the rapid improvement of innovation capacity. Research data from Xinhua shows that the economic benefits of digital transformation are significant, with each 10% increase in digitalization leading to a 0.5%-0.62% increase in GDP per capita.

At the theoretical level, scholars in the field of strategic management and information systems have begun to pay special attention to digital transformation in the last 20 years and have been in the midst of a 2019 to Today, a new wave of research has been launched. At a high level, digital transformation encompasses the profound changes taking place in society and industries through the use of digital technologies[1, 2]. At the organizational level, it has been argued that firms must find ways to innovate with these technologies by devising “strategies that embrace the implications of digital transformation and drive better operational performance”[3]. Foreign scholars, represented by YOO, NAMBISAN, and VIAL, have made useful explorations in digital transformation research, which has advanced from emphasizing the use of specific technologies to focusing on the deeper waters where technology has a comprehensive and transformative impact on enterprises.

2. Methods

This paper uses a systematic literature approach to sort out existing research on digital transformation in enterprises. In the first step, in order to obtain literature on digital transformation, a literature search was conducted with the keywords. We searched the Web of Science, Scopus and China Knowledge Network with the keywords "digital transformation" and "digitalization" and obtained 299 academic journal papers. In the second step, the papers without peer review were excluded, and the target of digital transformation was limited to enterprises, and the time of publication was controlled, that is, from 2003 when Andal-Ancion et al. [4] introduced digital transformation into the field of business administration, and a total of 194 papers from 2003 to March 2021 were identified. In the third step, the abstract and conclusion of each article were read, and the suitability of the content was assessed by whether the title, abstract, or keywords reflected the research topic of "digital transformation of enterprises", and the articles published in the JCR subject partition of region 3 or above were screened. We further screened the references of the above-mentioned papers, and finally selected a total of 37 papers.

The total citation ranking of the papers is shown in Table 1. It can be found that there are three main categories of high-frequency cited literature in this field, as follows: i) foundational literature introducing how digital technologies challenge traditional management theories[4], usually from journals in the fields of strategic management and information systems, which provide a knowledge base such as the characteristics of digital technologies and reflect the interdisciplinary characteristics of digital transformation research; ii) the use of text (ii) literature that uses textual analysis and thus generates insights on digital transformation, mainly in the form of review studies[5]; and (iii) emerging literature on digital transformation strategies, dynamic evolution, and other directions[6, 7].

Overall, digital transformation research shows a trend of increasing year by year and has It has become a hot research

issue. However, the research on digital transformation is still in the exploratory stage, and there are obvious shortcomings. For example, the connotation of digital transformation is vaguely defined, the theoretical perspective is single and focused on the technical perspective, and the study of the transformation process has just started. In particular, the connotation of concepts related to digital transformation is not well defined, which not only restricts scholars' understanding of digital transformation, but also limits the integration between different studies. This paper analyses the connotation of digital transformation from multiple perspectives and initially defines the concept of digital transformation. At the same time, this paper integrates a relatively complete research framework by reviewing and organizing the relevant literature at home and abroad and combining it with existing research on digital transformation.

3. Defining Digital Transformation

With the advent of the information age and the rapid development of digital technology, more and more business scholars at home and abroad are focusing on the phenomenon of digital transformation of enterprises. Although there is a large amount of literature on digital transformation, scholars have not yet reached a consensus on the definition of "digital transformation". Existing studies have defined digital transformation mainly from the perspectives of technology and value. Some scholars have also defined digital transformation from the perspective of strategic change. Table 1 summarizes the basic definitions of the meaning of strategic transformation in different dimensions.

Table 1. The basic connotation of digital transformation

Author	Year	Conception	Perspective
Gemini	2011	Digital transformation is the use of technology to radically improve an organization's performance or reach.	Technology
Berman&Bell	2012	Enterprise digitalization is about reinventing the customer value proposition and leveraging digital technology to transform operating models for greater customer interaction and collaboration.	Value
Solis	2014	Restructure or invest in new technologies, business models and processes that drive value for customers and employees.	Value
Zhou Zhiming <i>et al.</i>	2014	Digital transformation is the use of information technology tools and ideas to transform business structures and workflows.	Technology
Rogers	2016	Upgrading enterprise IT infrastructure, however, is fundamentally not about technology, but about strategy.	Strategy
Zimmermann <i>et al.</i>	2016	A generic term for converting information, processes, products, or services into a form that can be processed or supported by information technology.	Technology
LeonardHeili <i>et al.</i>	2017	The success of digital transformation lies not only in the use of advanced technologies and methods, but also requires a particular focus on organizational adaptation; digitalization in time is a means, not an end.	Strategy
Gray&Jeff	2017	Digital transformation is the process by which information technology processes data in real time, intelligently accesses information, and ultimately provides stakeholders with better information about their processes and products.	Value
Gobble, MaryAnne M.	2018	Digital transformation is the profound transformation of business and organizational activities, processes, capabilities, and models to strategically and prioritistically leverage the changes and opportunities presented by the digital technology portfolio.	Strategy
Merve Güler <i>et al.</i>	2019	Digital transformation is the integration of digital technologies into a company's activities to keep pace with the changing competitive environment, radically improve performance, and enhance the customer experience by creating new value chains.	Value
Xiao Xu <i>et al.</i>	2019	The digital transformation of industry is to meet the needs of enterprises to achieve the value dimension of high-quality development through the use of digital technology in business operations.	Value

3.1. Technical Perspective

Early scholars in the study of digital transformation of enterprises focused their sight on the important role of information technology in business operations. Digital transformation refers to the more intensive and widespread application of commercial information technology and information and communication technology (ICT) in traditional enterprises[4]. Gemini[8] sees digital transformation as a technology-led approach that uses digital

technology to fundamentally promote operational efficiency and improve business performance as a way to build a new digital economy. Zhou[9] believes that using the means and ideas of information technology to change the enterprise structure and workflow is digital transformation. As can be seen, studies based on the technology application perspective still associate digital transformation with the early stages and activities of information technology in history[10].

3.2. Value Perspective

As digital transformation has been studied in depth, scholars have gradually shifted to understanding digital transformation at the value level. Some scholars, such as Berman, believe that digital transformation of enterprises is a transformation at the level of thinking, by reshaping the customer value proposition and transforming the operating model using digital technologies. Gobble[11] pointed out the difference between digitization and digitalization, arguing that digitization brings savings by increasing efficiency and reducing error rates, but does not change the way companies create and deliver value; digitalization changes everything, and is a profound transformation of business and organizational activities, processes, capabilities, and models. Accenture[12] proposed that digitalization must run through the entire enterprise to make it create value. Xiao[13] believes that industrial digital transformation is to meet the needs of the value dimension of enterprises to achieve high-quality development through the use of digital technology in business operations, and analyzes the value impact of industrial digital transformation in four aspects: industrial efficiency improvement, industrial cross-border integration, reconfiguration of industrial organization competition model, and empowerment of industrial upgrading, and explains the mechanism of the impact of digital technology use on traditional industrial upgrading.

3.3. Strategic Transformation Process Perspective

In terms of research on enterprise digital transformation, academia has largely gone through a process of understanding from technology application to value creation and then to cross-system change. According to the 2020 China Enterprise Digital Transformation Index[12], the percentage of Chinese enterprises that are significantly effective in digital transformation is only 9%, with an average score of only 45. Digital transformation is easily misunderstood as a way to improve performance as long as companies adopt emerging technologies. However, in fact, a large number of enterprises have adopted new technologies to implement transformation, but their performance is not as good as before the transformation, or even suffer from business crisis. The reason for this is that companies cannot effectively identify whether their existing business needs to be improved by incorporating digital technologies, and it is difficult to define a specific path for how to do so. The digital transformation practices of global enterprises are in urgent need of a systematic theoretical framework with realistic insight and strategic orientation to guide them[14].

Agarwal *et al.* [14] argues that digital transformation is fundamentally not about technology, but about strategy; true digital transformation is the ongoing process of using digital technologies in daily organizational life to create value for the enterprise[15]. In summary, based on the perspective of strategic change process, the connotation of digital transformation of enterprises is defined as follows: digital transformation is a comprehensive and all-round strategic transformation process that involves innovations in information technology, human resources, business models, and operating models, from management to operations, from production to sales, and from leaders to employees, through the use of digital technology.

4. Influence Factors of Digital Transformation Based on TOE

The manuscript should include a conclusion. In this section, summarize what was described in your paper. Future directions may also be included in this section. Authors are strongly encouraged not to reference multiple figures or tables in the conclusion; these should be referenced in the body of the paper.

4.1. Technological Drivers of Enterprise Digital Transformation

The study of technology dominates the existing research on digital transformation of enterprises. Although there are different views on the definition of the connotation of digitalization, scholars agree that the study of enterprise digitalization is inseparable from the development of information technology. The new generation of digital technologies is rapidly changing the consumer behavior and business environment, forming a profound impact on economic structure, industrial upgrading and social development, constituting an important force for disruptive innovation in enterprises and becoming the most critical driving factor for digital transformation of enterprises. In particular, the deep integration of digital technologies with the real economy enables enterprises to achieve multi-channel interaction, which brings about a series of innovative shifts in technology, products and markets, and becomes a direct factor driving the transformation of enterprises from industrialization to digitalization[16].

The technology factor in the TOE framework refers to all technologies that are relevant to the company, including those already used by the company and those that are available on the market but not yet used[17]. Among them, enterprise information systems and production technologies have a positive impact on the digital transformation of the company.

4.1.1. IT System

The enterprise information system is divided into the information transmission system established by the enterprise to complete the exchange of information with the outside and the information communication system to realize the exchange of information within the enterprise. In the process of achieving information exchange with the external environment, companies strengthen their awareness of digital-for-transformation through the role of information penetration and information flow[18]. Information penetration controls the information transfer environment and boundaries, helps companies to obtain knowledge guidance from experts and mentors in their industry field, and makes them aware of the need to change their current business model. Information flow, on the other hand, refers to the movement of relevant information from the consumer side to the enterprise side in the value creation process, and this information flow, which is steadily improving along with the environment, helps develop the urgency to make changes to the existing business model. Therefore, the establishment of information systems for exchanging information with external parties through information permeability and information flow is a key factor in driving digital transformation in companies. The construction of a fully communicated and efficient information system within the enterprise improves the degree of information sharing and the efficiency of communication and decision-making within the enterprise on the one hand; on the other hand, the

establishment of an information system makes the enterprise a holistic organization with an active, open and creative mind[19].

4.1.2. IT capabilities

Existing literature suggests that information technology is one of the most important factors for companies to achieve digital transformation, facilitating the optimization of business processes and creating customer and enterprise value[20]. The advantage of information technology lies not only in the technology itself, but crucially in the development and application of IT capabilities. According to the enterprise resource base view, IT infrastructure by itself is not sufficient to gain competitive advantage because it is too easily imitated by other organizations; the ability to use IT infrastructure in a specific context is the key to creating value for the enterprise[5]. IT management capabilities provide support for organizational management innovation, etc., including the regularization of various information and resources, helping to build the enterprise network, and rapid response to external changes and serve strategic corporate decisions[21]. IT infrastructure and IT management capabilities complement each other and together contribute to the value creation of IT in value chain activities.

4.1.3. Production Technology

In the era of digital economy, in the face of increasing user requirements for enterprise products or services, the use of digital technology for manufacturing is like an added wing for enterprises. Studies have shown that whether it is upgrading the production of new front-end parts using artificial intelligence technology or adopting the production line process of smart manufacturing, having the production technology capability ahead of other industries in the same industry is a key factor for the success of digital transformation of enterprises[22].

4.2. Organizational Drivers of Enterprise Digital Transformation

The organizational perspective emphasizes the important role of organizational factors in digital change from the perspective of the interaction between the internal organization and the external environment[23] "Organizational factors in the TOE framework refer to the influence of organizational management factors on technology, including organizational resources and capabilities, organizational strategy, organizational structure, and managerial traits. These factors influence digital transformation by influencing the adoption and implementation of organizational digital transformation decisions.

4.2.1. Resources and capabilities

Enterprises are usually regarded as a collection of various resources, and in the case of major changes in the business environment and critical transitions in business management, making full use of the existing resources of the enterprise can guarantee the smooth strategic transformation and help the enterprise quickly adjust itself and re-match with the external environment, so as to realize the long-term development of the enterprise[24]. By providing enterprises with unique resources, digital sensing and capturing capabilities, and resource allocation capabilities for rapid adaptation to the external environment[23, 25], it enables enterprises to make rapid directional adjustments to tide over business crises through digital transformation. However, some scholars have

also argued that the existing resources of enterprises have a hindering effect on digital strategic transformation based on theoretical perspectives such as organizational learning, organizational inertia, organizational commitment, and organizational surplus[23].

4.2.2. Digitalization Strategy

Organizational strategy plays a key role in creating awareness of digital transformation by establishing a precise picture of goals that provide a viable blueprint of digital strategy for the enterprise[15]. The goals of an organization's digital strategy can be interpreted in different directions. For example, the goals can be customer centricity, increased efficiency, improved internal processes, or new business models. The development and implementation of a digital strategy is a process that involves all aspects of the enterprise, so managers should take care to integrate and communicate across all departments of the enterprise and across the entire process when developing and implementing an enterprise digital strategy. The digital strategy expresses the vision, mission, and goals of the enterprise transformation[15], and through active communication from top to bottom by managers, all employees are mobilized to actively participate in the digital transformation of the enterprise, creating an organizational climate for the enterprise that is open to digital transformation and willing to learn digital expertise, and forming a good corporate culture that is easy to generate digital transformation. This is the key to promote the successful digital transformation of enterprises.

4.2.3. Organization Structure

A flat organizational structure is an important factor for enterprises to carry out digital transformation in the new business environment. Digital transformation strategies require horizontal organizational coordination[26], and a flat organizational structure facilitates the reduction of communication barriers between organizational levels, improves the efficiency of business operations, and accelerates the digital transformation of business processes. At the same time, a flat organizational structure also creates structural convenience and possibilities for organizational learning and an open and inclusive corporate culture[19]. Therefore, organizational factors play a crucial role in the digital transformation of enterprises.

4.2.4. Senior Management

Senior managers play the role of leaders, decision makers and communicators in the process of digital transformation. Senior echelon theory suggests that managers' cognitive structures and values influence their ability to interpret relevant information, and therefore managerial traits influence their strategic choices and, consequently, corporate behavior[27]. When managerial traits are manifested through managerial behavior, they have an impact on stakeholders, organizational structures and systems, and changes in strategic content under organizational and environmental conditions[28]. Studies have shown that both the degree of position dispersion and task focus of CDOs can have an impact on the numerical transformation of companies[26]. Similarly, executive teams lacking digital experience are an important barrier to digital transformation in organizations, and Bouchikhi and Kimberly note that senior leaders often struggle to fundamentally change the organization's business model when these teams are unable to escape the identity trap[29].

4.3. Environmental Drivers of Enterprise Digital Transformation

The organization is an open system, and open systems have the ability to sustain themselves, which is based on processing the resources obtained from the environment. Therefore, the environment is the source of the system's ability to sustain itself, its variability and diversity[23]. Environmental factors in the TOE framework often refer to the characteristics of the environment, such as the uncertainty of the environment[30], including the macro-environment and the industry environment. Based on stakeholder theory, factors such as intense competition in the industry or adjacent industries, changes in customer demand for products, and digital transformation of suppliers are the main triggers for creating and delivering new value propositions[25].

Gupta and Bose argue that firms need to develop their strategies based on their dynamic interactions with the environment, and thus the dynamic, uncertain and complex nature of the environment forces firms to change their existing strategies by developing new business ideas[18]. Under the dynamic dimension of the environment, innovation, changing customer tastes, and technological advances are key factors in the digital transformation of firms; under the uncertainty dimension of the environment, socioeconomic attributes and industry competition drive the digital transformation of firms; under the complexity dimension of the environment, the requirements of heterogeneity and interaction of the business environment become important driving factors in the digital transformation of firms.

4.3.1. Industry digitization level

In the digital economy, the level of digitalization of the industry is an important support for the formation of competitive advantage. The digitalization level of industry is an important support for forming competitive advantage.

When companies face the competitive pressure of competitors and partners' digital development, it will stimulate the enthusiasm of companies to innovate and promote the development of digital transformation[23]. Related studies have shown that companies in higher-technology industries are more innovative than those in lower-technology industries[31].

4.3.2. Policy Support

Companies are constrained by their resources and capabilities and are often unable to compete with large enterprises using their own resources and capabilities alone. Without the support of external parties, Companies cannot achieve digital transformation. It has been shown that government support is an important factor for the success of digital transformation of enterprises[32]. As policy makers, governments can support the digital transformation agenda of SMEs by developing and strengthening supportive policies and programs.

4.3.3. Partner Relationship

The success of digital transformation in enterprises requires transforming organizations by creating a dynamic ecosystem of partners[32]. The formation of inter-organizational relationships can help organizations to access resources, reduce uncertainty and interdependence. Existing research shows that companies can achieve business growth even with limited resources by building partnerships with partners[33]. External collaboration is a way to obtain additional resources that can compensate for the company's own shortcomings and help it obtain the necessary conditions for digital transformation. Therefore, partnership building and value co-creation mechanisms have become important factors for companies to achieve digital transformation as a way to access collaborative resources, realize synergies and create market value.

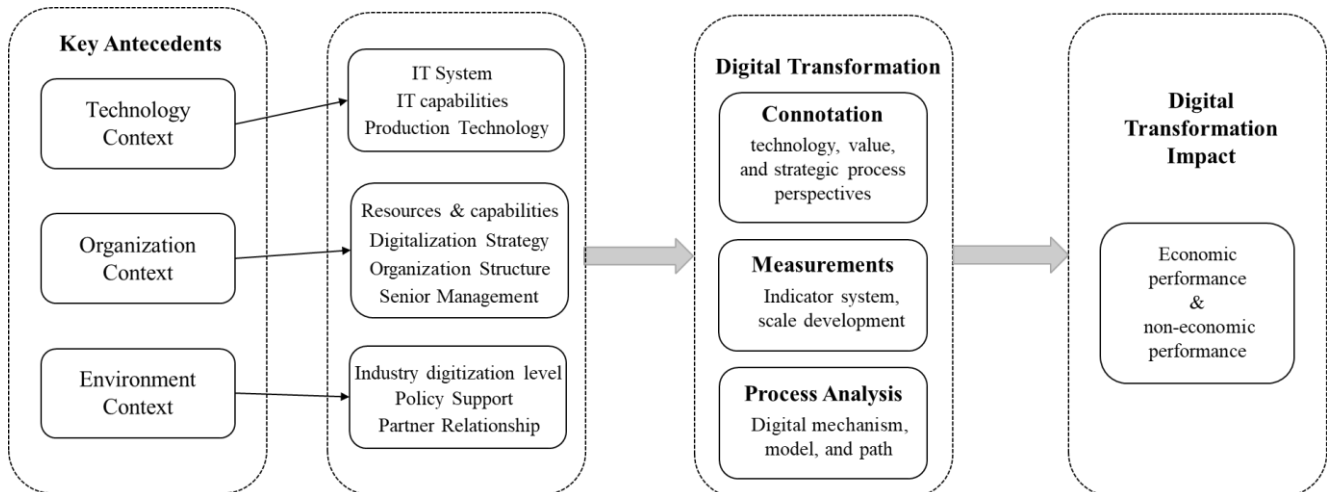


Figure 1. The basic framework of digital transformation research

5. The Framework of Digital Transformation Research

Comprehensively, the current digital transformation research mainly has several shortcomings: first, the concept of digital transformation lacks a unified definition, leading to the lack of measurement of digital transformation; second, the exploration of the impact factors of digital transformation is insufficient, although there are studies involving the study of

the drivers of digital transformation, most of them analyze the drivers of digital transformation from a single perspective, lacking the integration of multiple integration research of multiple theoretical perspectives, and insufficient analysis of the influence mechanism of the drivers and lack of exploration of their hindering effects; third, the research on the process of digital transformation is still in the initial stage, and scholars mostly try to open the black box of the digital transformation by means of case studies, but overall there is still a lack of the process of digital transformation mechanism;

fourth, the research on the consequences of digital transformation is limited to the economic performance of enterprises, ignoring the research on enterprise competitiveness, organizational structure, corporate culture and stakeholder feedback, etc. In view of the existing research deficiencies of digital transformation of enterprises, this paper tries to establish a basic framework(Figure 1.) for the study of digital transformation of enterprises.

Through reviewing and organizing the existing literature at home and abroad, this paper attempts to extend and integrate the existing research on digital transformation by introducing the TOE framework and integrating multiple theoretical perspectives, and analyze the differentiated impact mechanisms of key drivers on digital transformation. First, the existing studies on transformation drivers usually only select a single perspective from technology, organization and environment, and have not really clarified the mechanism of the impact of these drivers on strategic transformation. The framework constructed in this paper highlights the integration of three different perspectives in the study. Second, from the study of digital transformation itself, there is a lack of uniform definition of the connotation, mainly due to the neglect of the holistic changes of digital transformation, which leads to the ambiguity of the measurement of digital transformation. The framework constructed in this paper defines a multidimensional concept of digital transformation, aiming to highlight the systematic change characteristics of digital transformation. In addition, digital transformation is a systematic change process, and the study of the strategic transformation process is related to the success or failure of the transformation. Only a deeper understanding of the mechanism and process of transformation can guarantee the implementation effect of transformation. Therefore, the exploration of the transformation process is highlighted in the framework constructed in this paper, aiming to emphasize the importance of the transformation process in the study of strategic transformation. Finally, digital transformation outcome measures should not only include economic performance, but also non-economic performance.

6. Future Research

The current research on digital transformation of enterprises has deficiencies in connotation, measurement, process and theoretical foundation, and these deficiencies can point out the direction for future research. In this paper, we believe that the research on digital transformation can focus on the following aspects in the future: (1) to conduct in-depth research on the concept of digital transformation and

systematically establish a clearer conceptual model of digital transformation based on different perspectives and different dimensions; (2) to develop in-depth measurement indicators and scales of digital transformation based on a clearer definition of the basic connotation of digital transformation; (3) to integrate multiple theoretical (3) analyze the influencing factors of digital transformation and their specific influencing mechanisms from multiple theoretical perspectives, and explore the relationship among the influencing factors; (4) adopt multiple research methods to explore the process mechanism of digital transformation of enterprises; (5) analyze the impact of digital transformation on enterprises in various aspects.

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