

Digital Transformation: A Literature Review and Future Research Agenda

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Abstract

Digital transformation (DT) has received growing attention as it emerged as a pivotal force in reshaping modern enterprises and societies over the past two decades. Despite the global emphasis on researching DT, its precise conceptualization and definitive boundaries remain unclear. This paper offers a comprehensive review of the existing literature on DT, providing an in-depth analysis of its conceptualization, key influencing factors, measurement approaches, and economic consequences. Additionally, this study identifies critical research gaps, providing insights to guide organizations in navigating their digital transformation process while informing future research directions. By addressing these gaps, this paper contributes to the development of more effective DT strategies and highlights the need to mitigate its potential negative impacts on society and the environment.

Keywords Digital Transformation, Digital Technology, Business Model Innovation, Dynamic Capabilities, Privacy and Ethics

Introduction

In the digital era, digital transformation is widely anticipated for its profound impact, not only driving fundamental changes across industries but also reshaping societal structures and dynamics. As a strategic and comprehensive process, it leverages digital technologies to redefine business models and production processes, enhancing operational efficiency and maximizing value creation (He & Liu, 2019). Although the concept was first explored in 1981, a substantial surge in scholarly publications did not emerge until the early 21st century, reaching its peak in 2020 (Kraus et al., 2021). Despite its growing prominence, the precise definition, implementation pathways, measurement criteria, and overall impact of digital transformation remain subjects of ongoing academic discourse. This paper synthesizes existing literature and proposes a conceptual framework encompassing five key dimensions: (1) the conceptualization of digital transformation, (2) its driving factors, (3) measurement approaches, (4) economic consequences, and (5) implications for future research. By offering a structured perspective, this study contributes to the theoretical understanding of digital

transformation and provides a foundation for future empirical research and managerial practice in an increasingly digitalized business environment.

Conceptualization of Digital Transformation

Jensen (1981) is recognized as the first peer-reviewed scientific publication addressing the concept of digital transformation (DT), with a particular emphasis on technology and data management within digitized systems. However, over the last decades, a universally accepted definition has yet to be established and its boundaries remained indistinct. Digital transformation (DT), as a multidimensional concept, is typically understood as the profound reconfiguration of traditional business processes, models, organizational structures, and cultures through the application of advanced information technologies such as the Internet, artificial intelligence, and big data. This transformation can be broadly categorized into two three dimensions: technical support , organizational change and social impact.

From a technical support perspective, scholars adopting this perspective primarily focus on the specific role of digital technologies in driving organizational efficiencies and expanding technological capabilities. For example, Westerman et al. (2011) posited that digital transformation involves leveraging information technology to enhance organizational performance and expand market influence. Fitzgerald et al. (2014) further defined it as the integration of emerging digital technologies to drive significant business advances including enhancing customer experiences, optimizing operational efficiency, and developing innovative business models.

Conversely, from an organizational change perspective, digital transformation is primarily viewed as a series of changes occurring at the level of business models and value creation processes. Hess et al. (2016) defined it as the strategic use of digital technologies to drive changes in an organization's business model, leading to innovations in operational processes or organizational structures. Similarly, Vial (2019) described digital transformation as the process by which organizations employ digital technologies to adapt their value creation mechanisms in response to environmental shifts. From this standpoint, digital transformation involves the deep integration of digital technologies with a company's core business functions, driving significant shifts in business models and organizational structures, and ultimately resulting in transformative organizational outcomes.

Moreover, from a social impact perspective, Hinings et al. (2018) pointed out that DT encompasses the synergistic impact of multiple digital innovations, leading to the emergence of new actors, structures, practices, values, and beliefs, which would influence established paradigms within organizations, ecosystems, industries, and broader institutional frameworks. Moreover, Kraus et al. (2021) firstly conducted a co-occurrence analysis using the VOSviewer software and categorized DT into three distinct clusters, focusing on its technological, business, and societal impacts. They also pointed out main implications of DT on institutions and societies including negative and positive aspects. In summary, digital transformation is not solely a technical or technological process but a holistic, multifaceted change that necessitates among technological innovation organizational adaptation and societal implications. These three dimensions-has been central to shaping the way scholars and practitioners understand and navigate the digital transformation.

Influencing Factors of Digital Transformation

Digital transformation is driven by a complex interplay of internal and external factors that compel organizations to adopt and integrate digital technologies. From an internal perspective, several key elements contribute to a company's ability to successfully undergo digital transformation, including financial resources, a skilled workforce, dynamic capacities, flexible organizational structures etc. Hess et al. (2016) examined the digital transformation efforts of three media companies in Germany and found that financial constraints were a significant barrier to the adoption of digital technologies. In parallel, Colbert et al. (2016) emphasized that effective integration of digital technologies into business operations requires not only attracting IT talent but also fostering digital literacy across all departments. This approach is vital for solving complex business challenges and building a digitally proficient workforce that can drive the transformation process. Furthermore, Karimian and Walter (2015) illustrated how dynamic capabilities, such as the ability to build and scale digital platforms, can accelerate digital transformation. Eggers and Park (2018) also noted that a flexible organizational structure is essential for rapidly adapting to an ever-changing environment, a critical factor for the success of digital transformation initiatives.

From an external perspective, technological advancements and industry developments play a crucial role in pushing organizations toward digital transformation. Industrial digitalization, in particular, profoundly influences industrial structure, competitive dynamics, and consumer behavior, creating significant pressure for companies to adapt. Kahre et al. (2017) argued that industrial development is an essential driver of digital transformation, as it reshapes both the competitive landscape and market demands. In addition, Wu et al. (2021) underscored the importance of external foundational conditions, such as regulatory frameworks, infrastructure, and technological ecosystems, in determining the effectiveness of digital transformation efforts. Moreover, Kraus et al. (2021) highlighted that technologies such as big data, artificial intelligence, and data analytics play a crucial role in driving the success of digital transformation. In summary, both internal and external factors interact to shape the trajectory of digital transformation, with financial, organizational, and technological influences acting as key determinants of success.

Measurement Approaches of Digital Transformation

The rapid integration of emerging digital technologies has significantly advanced the methodologies for measuring digital transformation, with three key approaches gaining prominence: information technology (IT) capability assessment, digital investment evaluation, and text analysis of annual reports (see Table 1).

The first method involves assessing a company's IT capabilities. Bayo-Moriones et al. (2013) conducted interviews with small and medium-sized enterprises (SMEs) in the Spanish manufacturing sector, identifying three key dimensions of informatization: general office automation, communication systems, and market orientation. Li and Gao (2013) expanded upon this by categorizing IT investment into hardware and software components, using items from annual reports, specifically those related to fixed and intangible assets, as metrics for evaluating digital investment.

The second method employs quantitative analysis of the proportion of digital assets in the notes to the annual report. Qi et al. (2020) highlighted that the inclusion of specific items

related to emerging digital technologies in the intangible assets section of annual financial reports is indicative of a high level of digital transformation. Building on this, Huang et al. (2021) further categorized digital resources within fixed and intangible assets in the annual report's notes. They assessed the digital transformation of Chinese listed companies by calculating the ratio of digital-related assets to total assets, providing a clear metric for measuring digital maturity.

The third method focuses on text analysis, particularly through keyword frequency statistics in annual reports. This approach acknowledges that digital transformation is not only reflected in financial investment but also in strategic shifts and changes to business models. He and Liu (2019) noted that a company's development strategy is often articulated in its corporate announcements, and digital transformation can be effectively tracked through keyword analysis. Qi and Cai (2020) utilized big data crawling technology to extract and analyze the frequency of terms related to digital transformation, creating proportional indicators as a measure of digital progress. Wu et al. (2021) innovatively applied Python-based crawler technology to count the occurrence of keywords like "digital transformation" in the annual reports of listed companies, using the frequency of these terms as a proxy for digital transformation intensity.

Table 1

Three Methods to Measure Degree of Digital Transformation

		Scholars	Measurement
Method 1	Information technology (IT) capability assessment	Bayo-Moriones et al. (2013) Li and Gao(2013)	Use dummy variables (hard wares, soft wares, etc.) to measure
Method 2	Digital investment evaluation	Qi et al. (2020), Huang et al. (2021) Zhang et al. (2021)	Use the proportion of digital technology intangible assets to intangible assets to measure
Method 3	Text analysis of annual reports	He and Liu (2019) Qi and Cai (2020) Wu et al. (2021)	Use text analysis method to extract the frequency of words related to DT from the annual report

In summary, these three measurement approaches-assessing IT capabilities, analyzing digital asset investment, and conducting keyword frequency analysis-provide comprehensive tools for evaluating the extent and impact of digital transformation within organizations, which

offer valuable insights into how companies are navigating and measuring their digital journeys, both in terms of technology adoption and strategic realignment.

Economic Consequences of Digital Transformation

The key advantages of digital transformation is its ability to efficiently and transparently process and transmit information(Zaheer and Zaheer, 1997; Hansen and Sia, 2015; Tan et al. 2016; Zhang et al., 2021). Firstly, the application of digital transformation liberates businesses from the constraints of time and space, thereby facilitating access to an abundance of information. Zaheer and Zaheer (1997) pointed out that companies equipped with extensive information networks tend to exhibit greater adaptability in navigating environmental changes.

Secondly, digital transformation expedites business model innovation and fosters novel forms of collaboration among companies. Parida et al. (2016) conducted a survey of 219 small high-tech companies in Sweden, revealing that those with information technology advantages can enhance their dynamic capabilities by streamlining internal efficiency and forging deeper connections with customers and suppliers. Pagani and Pardo (2017) pointed out that within the production process, digital technology empowers companies to delve into customer preferences, design and develop novel products, deliver higher-value added services to customers, enhance user experience, and ultimately create augmented value.

Thirdly,digital transformation initiatives within enterprises had a marked and statistically significant impact on augmenting stock liquidity. Wu et al. (2021) conducted a comprehensive investigation encompassing data from listed companies in China spanning the period from 2007 to 2018 and examined the empirical ramifications of enterprise digital transformation on stock liquidity dynamics.

On the other hand, digital transformation would lead to disruptive changes, causing current business becoming obsolete due to rapid innovations in digital technologies(Parviainen et al., 2017).

Discussion and Future Research Agenda

Sustained academic interest in digital transformation showed an exponential growth in scientific output since 2018 (Kraus et al., 2021).Despite the fact that digital transformation has emerged as a prominent research focus within both academic and practical spheres, numerous areas yet remain ripe for in-depth exploration. Future research trajectories are likely to encompass the following salient aspects.

Firstly, the industry-specific characteristics of digital transformation warrant closer scrutiny as varying industries encounter disparate sets of challenges and opportunities during the implementation of digital transformation initiatives. Therefore, devising differentiated transformation strategies that are finely attuned to the idiosyncrasies of different industries represents a crucial avenue for future research endeavors,which would entail a detailed analysis of industry structures, value chains, and regulatory landscapes to formulate bespoke approaches that optimize the benefits and mitigate the risks associated with digital transformation.

Secondly, the role of dynamic capabilities in the context of digital transformation is an area of burgeoning interest. In an environment characterized by rapid technological flux, understanding how the dynamic capabilities of enterprises shape the sustainability and profundity of their digital transformation efforts will constitute a novel and significant research topic. This necessitates an exploration of how organizations can cultivate and leverage capabilities such as adaptability, learning agility, and innovation to not only keep pace with but also anticipate and drive technological change, thereby ensuring the long-term viability and competitiveness of their digital transformation initiatives.

Thirdly, Digital innovations are driving an increasing volume of research, with particular emphasis on the complex interplay between artificial intelligence (AI) and digital transformation. As AI technologies continue to evolve, their expanding applications within digital transformation warrant deeper exploration and theoretical refinement. Consequently, comprehending the profound and far-reaching impact of artificial intelligence on transformation strategies and operating models remains an area in need of extensive and in-depth discussion. This would involve an examination of how artificial intelligence can be harnessed to enhance decision-making, optimize processes, and redefine customer experiences, as well as the associated ethical, legal, and social implications that accompany its integration into digital transformation initiatives. By delving into these aspects, future research can contribute to a more comprehensive and nuanced understanding of digital transformation and its multifaceted implications for organizations and society at large.

Conclusion

In conclusion, as a critical driver of innovation and development across enterprises and industries, digital transformation is increasingly becoming the new standard in global corporate competition. Although digital transformation is a complex and multidimensional process that fundamentally reshapes business operations and value creation, challenges remain in defining its scope and determining effective implementation strategies. This paper contributes to the ongoing discourse by identifying six key domains of digital transformation and presenting a conceptual model that integrates its meanings, influencing factors, measurement approaches, economic consequences, and implications for future research. By providing a structured perspective, this study lays a foundation for deeper exploration and offers insights to guide both academic inquiry and practical applications in the digital era. Future research would prioritize investigating the sustainability of digital transformation, the industry-specific adaptability of transformation strategies, and the profound impact of emerging technologies on the trajectory of digital transformation

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