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RESEARCH ON KEY INFLUENCING FACTORS OF DT OF SMEs IN CHINA

Zhang Yujie[1], Sidah Idris[2*], Jaratin Lily[3]

[1] Faculty of Business, Economics and Accountancy, University Malaysia Sabah, Malaysia; Beijing Union University, China
Email: buu_zyj@sina.com
[2] Faculty of Business, Economics and Accountancy, University Malaysia Sabah, Malaysia
Email: syaidah@ums.edu.my
[3] Faculty of Business, Economics and Accountancy, University Malaysia Sabah, Malaysia
Email: jaratin@ums.edu.my
[*] Corresponding Author

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Abstract:

With the new round of technological revolution and industrial transformation is accelerating and leading various aspects of society toward digital transformation (DT). With the widespread application of digital technologies such as big data and cloud computing, the DT process of enterprises is constantly accelerating, and disruptive changes have occurred in product services, business processes, and so on. This article provides a systematic review of existing research on DT and identifies the influencing factors from the organizational level, management level, and environmental level based on the Strategic Change framework of Rajagoralan &Spertizer (1997). Subsequently, an integrated analysis framework was proposed that includes five configuration factors: digital transformation infrastructure, employee skills, management support, market uncertainty, and technology uncertainty. This article not only deepens the understanding of the causal complexity issues behind the success of SMEs' DT but also provides some beneficial insights for the practice of SMEs' DT.

Keywords:

SMEs, Digital Transformation, Strategic Change, Configuration Factors

Introduction

With the emergence of a new round of technological revolution and industrial transformation, the digital economy, with data resources as important production factors, integrated application of information and communication technology, and all-factor DT as important driving forces,

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has increasingly become a new model of economic development. In what has been referred to as the fourth economic revolution with information technology which is also known as the era of volatility, uncertainty, complexity, and ambiguity, digital technologies, such as big data, artificial intelligence, and the mobile Internet have accelerated digital transformation (DT).

For today's traditional enterprises, DT is no longer an optional question, but a must-have question that must be put into action. The wide application of DT has brought many benefits to traditional industries. These include rapid iteration of IT systems to improve business agility, optimizing the production process and improving production efficiency, extending the length of the industrial chain, expanding service links, etc. Besides, management cognition and actions are needed to govern these complex transformations. A DT strategy is essential to serve as a central concept to integrate the entire coordination, prioritization, and implementation of the DT process within a firm (Matt et al., 2015)

Additionally, DT is beneficial to the organization, including but not limited to improving organizational processes, enhancing customer value proposition, reducing product and service costs, achieving breakthrough innovation and competitive advantage, etc (Hanelt et al., 2021). Under these situations, emerging technologies mainly include the Internet of Things, cloud computing, big data, mobile Internet, artificial intelligence, etc, whose main application value is to connect real-time data (such as smartphones, connected devices, smart devices, wearable devices, mobile commerce, video surveillance, etc.) with modern technologies (such as cloud-native applications, big data architecture, super fusion technology, artificial intelligence, blockchain, etc.) through customers, products, and operations (Eller et al., 2020a).

Research has shown that DT promotes business innovation, enhances customers' consumer experiences (Zaki, 2019), improves performance (Ferreira et al., 2019), improves organizational efficiency, and achieves high-quality development (Bresnahan & Trajtenberg, 1995). However, under the wave of the digital economy, more and more enterprises are embarking on the paths of DT. Although a large number of enterprises have made DT their strategic core and invested a large number of funds in the DT process of enterprise information equipment and systems, industry survey data shows that only 9% of enterprises have achieved significant transformation results, achieving significant growth in business revenue and sales profits. Most enterprises still face the dilemma of transformation being difficult to achieve effective results. How to promote DT of enterprises and generate good corporate performance has become a hot topic of common concern in both academia and industry. Thus, it is essential to study the influencing factors and thus possible paths of DT which might help SMEs to promote the success rate and stay competitive in this digital economy age.

Literature Review

The Connotation of DT

DT refers to the process of improving the enterprise through the application of digital technologies such as information, computing, communication, and connection, which leads to the change in organizational attributes (Vial, 2019). By definition, it includes two parts: digitization and transformation. Digitization refers to the transformation of information from the real world to the digital world or the process of realization through information and communication technology. The transformation is related to organizational changes such as the company's business model, products, processes, and organizational structure (Matt et al.,

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2015). Gurbaxani & Dunkle (2019) proposed that DT can also facilitate enterprises to match the constantly changing digital business environment by reshaping a company's vision and strategy, organizational structure, processes, capabilities, and culture, etc.

Combining the current reality of China, based on the definition of DT by Hanelt et al., 2021, this study believes that DT also involves all-around changes in enterprise strategy, business model, operation adjustment, and organizational structure triggered by technology combination which emphasizes the process of organizational change by using digital technology to promote the acquisition of competitive advantage.

SME' DT from the Perspective of Strategic Change

Based on Rajagoralan & Spertizer (1997), enterprise strategic change is considered a systematic process of changing the initiation, implementation, and sustainability of enterprise strategic content to obtain a sustainable competitive advantage, according to the changes that have occurred or are predicted to occur and want to occur in the external environment or internal situation, adhering to the principle of dynamic coordination among environment strategy organization, involving the synchronous supporting changes of various elements of enterprise organization.

SME's DT is a multi-dimensional concept, which is summarized from the macro level as the use of digital technology to make profound changes in society and industry (Agarwal et al., 2010; Majchrzak et al., 2016); At the micro level, DT is seen as a behavior that promotes organizations to implement innovation and change activities (DeMark & Harcourt, 2004) and improve enterprise performance. From the perspective of organizational change, enterprise DT is a process that triggers organizational change through the application of digital technology, including organizational structure, business processes, business models, etc. Digital technology is not only changing enterprise structure but also redefining the functions of markets and clients. For example, enterprises can use new digital technologies to make significant business modifications and organizational changes, create new business models, reevaluate investment strategies, and then participate in a broader ecosystem, and adjust and optimize their interactions with customers, suppliers, and partners to maintain competitiveness (Karimi & Walter, 2015; Singh et al., 1986; Warner & Wäger, 2019).

Nadkarni & Prügl (2021) defines DT as a participant-driven organizational change triggered by technology-driven digital disruption. Sahu (2018) and others believe that DT is the change in organizational structure, process function, and business model caused by the adoption of digital technologies. Matt et al. (2015) believe that enterprise digitalization is the transformation of information from a simulated world to a digital world (such as storage) or the realization of the process through information and communication technology and that DT is related to changes in the company's business model, products, processes, and organizational structure. Verhoef et al., (2021b) divided the DT of enterprises into three stages based on a literature review: digitization, digitalization, and DT. (See Figure 1) The first stage refers to the transformation of data into digital information, the second stage refers to the use of information technology or digital technology to change the business process of the enterprise, and the third stage refers to the extensive changes involving the business model and other strategic aspects of the company. In this study, enterprise DT is defined as the process of using digital technology in production, products, and other aspects to finally realize strategic change.

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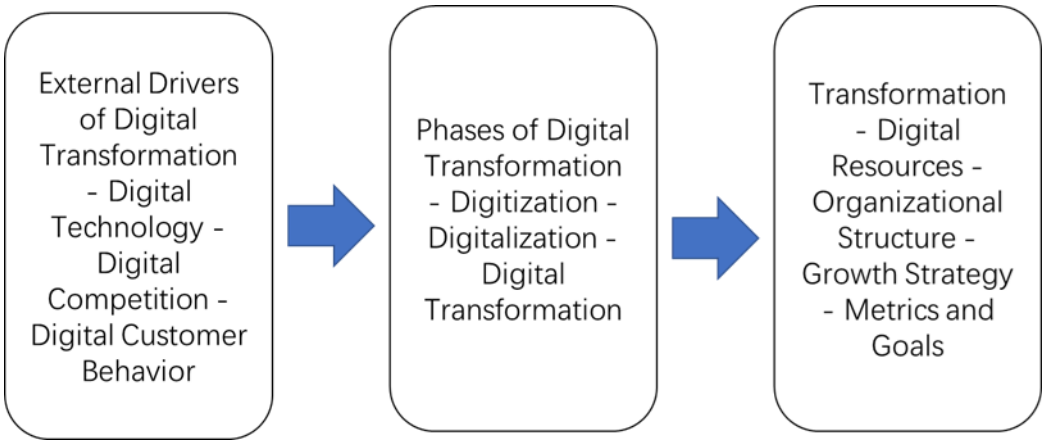

Figure 1: Flow Model for Discussion on Digital Transformation

Source: (Verhoef et al. (2019))

It can be seen that DT has become an important phenomenon, with increasingly rich connotations and extensions. With the deepening of research, more and more scholars acknowledge that DT is triggered by digital technology, represented by new generation information technologies such as artificial intelligence, blockchain, big data, the Internet of Things, cloud computing, etc; The scope of transformation involves various levels of the enterprise, including business processes, organizational structure, products and services, cooperation models, and especially changes in business models; The transformation results emphasize the use of digital technology to create new value propositions, which also involve changes in organizational characteristics, including enterprise positioning (goals), value creation systems, etc

The Influencing Factors of DT

Rajagoralan & Spertizer (1997)'s Multi-Lens framework is an extension of the rational, learning, and cognitive lens of perspectives of strategic change, providing a good theoretical perspective for studying and comprehensively analyzing the different influencing factors of SMEs' DT. This model reveals the antecedents and results of strategic change, "antecedents" are changes in environmental conditions or changes in the internal situation of the organization. The results of change affect enterprise performance. They introduced management behavior into the process of enterprise strategic change, which opened the "black box" of enterprise strategic management and made up for the deficiency that the content school theory of enterprise strategic change could not reflect the situation of the change process. The introduction of management cognitive behavior provided a potential logic for management behavior.

Because the Multi-Lens framework does not strictly specify the specific explanatory variables for the three types of factors, which has strong generality, applicability, and operability, scholars can freely change the factor variables based on the research field, research problem, and background, and continuously enrich the connotation of the framework in the context of differentiated technological applications.

With the widespread application of digital technology, the uncertainty of the external environment of enterprises is becoming increasingly strong, and the changes in competition rules are becoming faster. Their requirements for implementing corporate strategic changes are

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also becoming higher and higher. The DT of SMEs is also synchronously deepening. Many scholars have realized that the implementation of DT is inevitably influenced by many internal and external factors, so they have also begun to explore the factors that affect the level of DT in enterprises. These factors are crucial for DT, but from a configuration perspective, enterprise DT is a complex process influenced by multiple layers of factors, which are interrelated and will jointly affect the level of digital transformation through their linkage and matching (Fiss, 2011).

This study holds that the essence of SMEs' DT is strategic change. The Multi-Lens framework of Rajagopalan and Spreitzer (1997) provides a framework reference for this study to study the causes and consequences of SMEs' DT, as internal and external factors such as organization, environment, and management all have significant impacts on DT. Given this, this thesis will be based on the Multi-Lens framework and consider the synergistic effect of " organization-environment- management" on the level of DT from a configuration perspective, providing a scientific theoretical basis and decision-making reference for DT.

The research on the antecedents of enterprise digital transformation mainly includes: in terms of economic motivation, enterprises pursuing production efficiency, economic profit, and market position are more likely to digital transformation. In terms of the industrial environment, industrial digitization leads to changes in the industrial competition situation, value creation mode, and market demand mode, leading to the digital transformation of enterprises. In terms of the institutional environment, the digital transformation of leading enterprises in the industry has provided power and imitation objects for other enterprises; The government's release of supporting policies for intelligent manufacturing or the establishment of regional digital technology platform and cooperation system for enterprises can support the DT of enterprises. In terms of resource conditions, the construction of social networks can provide knowledge and technology for enterprises and promote the DT of enterprises.

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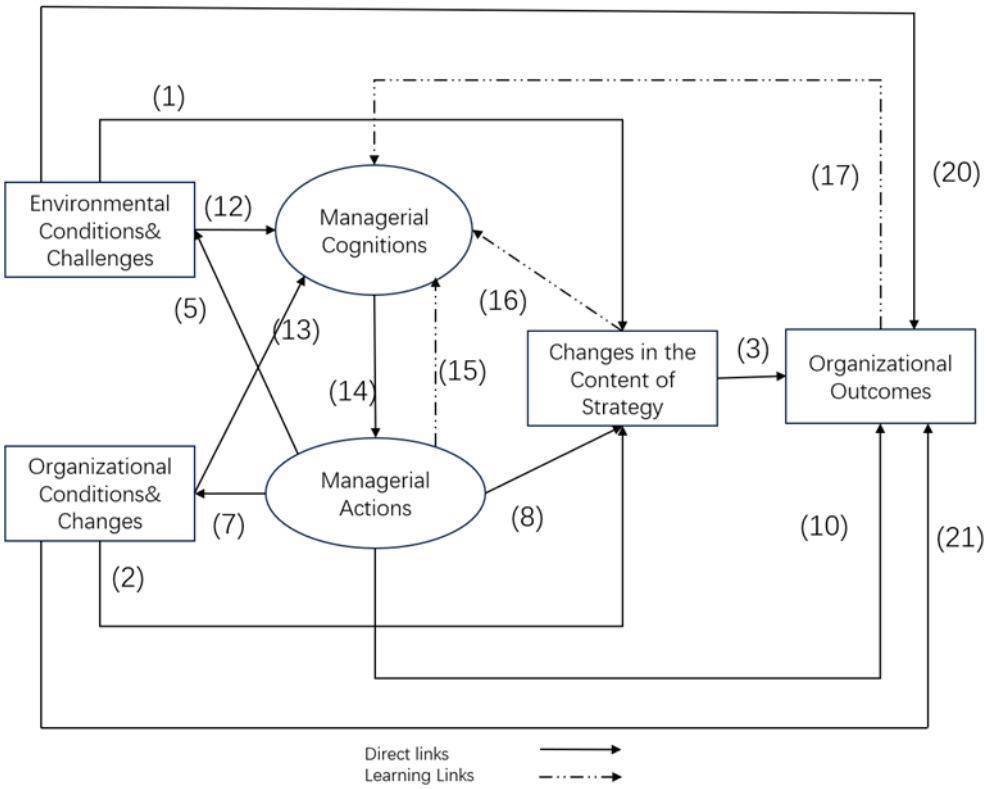

Figure 2: Strategic Change: A Multi-Lens Framework

Source: (Rajagopalan and Spreizer, 1996)

Organizational Level

Hanelt et al. (2021) defined DT as an organizational change that was caused and strengthened by the wide application of digital technologies. Most scholars focus on the organizational level when assessing the principal driving factors of digital transformation. These include the presence of a digital culture (Martínez-Caro et al., 2020). From this perspective, employee skills and digital technology infrastructure will be discussed on this level.

According to the resource-based view, the promotion of digitization needs a variety of complementary resources, among which human capital is one of the most important resources, in which the skills of employees are considered an important part of human capital. In the process of transformation and upgrading, the use of human capital is increasing. Increasing human capital investment is one of the main ways of enterprise transformation and upgrading. Once the big data analytics capability is built in, continuous training programs need to be put in place to update skills, as techniques become more advanced (e.g., Kübler, Wieringa, & Pauwels, 2017)

DT not only does not eliminate the dependence of enterprises on human capital but also puts forward higher requirements for the skills of enterprise employees (Hess et al., 2016), requiring employees to rely more on their analysis skills to solve increasingly complex business problems (Dremel et al., 2017). Eller R et al, (2020) found that the skills of enterprise employees have a significant positive impact on the digitization of small and medium-sized enterprises. Huawei's research shows that the lack of talent is one of the main challenges faced in the process of digital transformation in many industries.

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In the early stage of SMEs' business transformation, the internal IT management system was mainly introduced. This transformation focused on the improvement of the enterprise's internal business processes. IT infrastructure is the infrastructure supporting enterprise business processes, emphasizing the IT technology "hardware" resources owned by SMEs. However, with the development of the digital economy and technological progress, a large number of emerging digital technologies have emerged. The new generation of digital technologies puts more emphasis on emerging technologies such as big data, artificial intelligence, cloud computing, and the Internet of Things. Scholars at home and abroad mostly define digital technology from a narrow perspective. Nambisan et al. (2017) believed that digital technologies included cloud computing, social media, 3D printing, data analysis, digital products, digital platforms, and infrastructure. From the definition of digital technology by scholars, it can be seen that digital technology mainly refers to emerging technologies such as artificial intelligence, big data, and the Internet of Things. This study integrates the connotation of digital technology and its infrastructure and defines digital technology infrastructure as the digital technology resources such as artificial intelligence, big data, Internet of Things owned by enterprises.

The emergence and diffusion of various emerging digital technologies as raw materials have driven and shaped the digital transformation of enterprises (Brkić et al., 2020). Digital technology infrastructure might enhance the connectivity of internal devices within enterprises, enabling the development of new or enhanced products and services to be more effectively delivered to customers, and enabling a new way of organizing business (Gurbaxani & Dunkle, 2019).

Environmental Level

The environment is assumed to be objectively determined and manifested as a source of threats and opportunities (Chaffee, 1985) for SMEs. The uncertainty of the environment focuses on describing the unpredictability, external interference, and competitive intensity of the environment faced by enterprises in their business processes. With the reduction of industry concentration, the increase of competitors, and the transformation of customer demand, among other uncontrollable factors, the complexity of the environment will also increase. Normally environmental uncertainty can be divided into the market environment and technology environment. To be specific, environmental uncertainty is manifested in terms of technology as the speed of changes in industry technology, and in the market as the degree of changes in customer preferences.

The current market environment is characterized by rapid market changes, shortened product life cycles, diversity of customer needs, rapid technological updates, and supply uncertainty (Braunscheidel & Suresh, 2009; Dickson & Weaver, 1997; Sharma et al., 2017; Swafford et al., 2006). The environment is one of the most important sources of motivation for enterprises to seek innovation and change. Because enterprise management is highly sensitive to complex changes in the environment, it makes it more likely for companies to introduce or create new technologies, continuously launch new products and services, and adapt to changes in the environment(Jansen et al., 2006) The increase in environmental complexity will lead to an increment in management discretion, which in turn will trigger strategic changes in the enterprise. Therefore, as the product and service market is highly uncertain, enterprises can meet changing demands and match market development trends through DT to remain highly competitive.

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Technical uncertainty in this respect refers to the unpredictability of technological change, which is manifested in the complexity and novelty of technology (Dickson & Weaver, 1997). The rapid development of digital technology can lead to industrial change, and they can work together to cause environmental uncertainty and thus change how people discover and use opportunities. However, these changes can also bring about new opportunities. For instance, cloud computing can facilitate SMEs with big amounts of flexible resources on demand (Kane et al., 2015); big data analysis can fasten SMES decision-making and strategic responses (Gupta et al., 2020; Loebbecke & Picot, 2015). Therefore, high levels of technical uncertainty mean that SMEs must change their business activities promptly so that they can deal with more complex and innovative technologies. Thus, the uncertainties of digital technology can facilitate DT significantly.

In the context of the digital economy, both digital native enterprises and traditional enterprises are in a complex environment with strong environmental uncertainty and rapid changes in technology and demand. Environmental complexity has become the most prominent socio-economic background for enterprise development. Digital transformation is not an isolated enterprise practice, but a result of the joint development of enterprises and the environment (Chen, 2022). With the development of digital technology, the uncertainty of the external environment is also increasing (Belderbos et al., 2019), and DT has become a common choice for the vast majority of enterprises. Enterprises with high levels of DT are more likely to benefit from the opportunities brought about by rapid environmental changes and are more willing to promote transformation and develop competitive advantages. When most enterprises allocate and mobilize resources to promote DT, they will face the dual pressure of digital development from competitors and partners, thereby stimulating their enthusiasm for innovation and promoting the development of DT (Jin Jun et al., 2020).

Management Level

Based on the Upper Echelons Theory (UET), DT is an important decision-making and deployment of SMEs and it has a close relationship with senior managers. Thus, the strategic change of SMEs is deeply influenced by the top managers. Management cognitive ability refers to a manager's mental model, which is their ability to understand and predict events. Managers with strong management cognitive abilities can recognize the changes brought about by digital technology and continuously update their management cognition to support the transformation process of enterprises (Helfat & Peteraf, 2015). The research on the driving mechanisms and effects of DT in enterprises from the perspective of strategic selection can have an impact on the formulation and execution of enterprise decisions. Therefore, the digital cognition of management has become a key scenario driving digital transformation in enterprises.

In addition, in view with Rajagopalan and Spreitzer (1997), managers' actions are not only passively influenced by organizational conditions or the external environment, but also actively shape the opportunities and constraints brought by organizational conditions and the external environment. The continuous interaction between the environment and managers' actions enhances the learning effect of managers, to improve the effectiveness of strategic change and enterprise performance. In short, manager cognition is a bridge connecting internal and external situations and strategic change. Manager action is the core of the learning perspective, which believes that manager action is an important factor affecting strategic change. The management team is the leader of the enterprise's digital transformation, playing an important role in analyzing the DT environment, identifying DT opportunities, cultivating DT capabilities, and

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guiding the direction of enterprise DT. To date, there is no clear answer to which senior manager should be in charge of a DT strategy. In addition to CIOs or even CEOs, potential candidates include dedicated business transformation managers or the fairly new role of the Chief Digital Officer (CDO). In the process of DT driven by technological change in enterprises, problems such as insufficient management awareness and path dependence often lead to slow transformation progress, unsatisfactory transformation performance, and even transformation failure (Mattc, Hesst, and Benliana,2015). It is commonly believed that there was widespread cognition and action among management of the need to transform their businesses for the digital world.

The support of senior managers reflects the importance that enterprises attach to DT. A large number of studies on earlier IT adoption confirmed that high-level support was an important driving factor for the application of digital technologies such as information technology and e-commerce. Digital transformation requires enterprises to formulate a clear digital strategy (Eller et al., 2020b; Kane et al., 2015), integrate enterprise resources, and build a digital strategy team. The establishment of the position of chief digital Officer (CDO) in enterprises shows the importance of digital transformation strategy to enterprises (Vial, 2019). The strategy of raising the digital strategy to the management level will improve the possibilities of a successful transformation, and more resource allocations will help to improve the digital performance of SMEs (Bouwman et al., 2019).

Conclusion

Through the review of the literature related to the DT of SMEs, it can be found that the research results of the existing literature focus on the connotation, measurement, influencing factors, paths, and results of the digital transformation of SMEs, and the research results are relatively rich.

This study contributes to our knowledge of SMEs DT and the resources that need to be configured for this process to succeed. Digital technology infrastructure, employee skills, market uncertainty, technology uncertainty, and management support from the level of organization, environment, and management can significantly drive SMEs' DT. Thus, SMEs should invest in the corresponding resources of these three levels and increase their success rate.

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