The Influence of the Digital Economy on the Transformation of SMEs in the Manufacturing Industry

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Abstract: With the deepening execution of the 'fourteenth Five-Year Plan', the digital transformation of manufacturing small and medium-sized enterprises, which is also called SMEs, has reached a new peak in development. Within the framework of the digital economy, embracing digitalization has become a necessary means of survival for SMEs. This paper focuses on the manufacturing sector, outlining the challenges faced during the transformation of these enterprises. It highlights the benefits and risks posed by the digital economy in this process and proposes solutions in three key areas: technology, strategy and talent, which offer theoretical support and guidance for the digital transformation and sustainable growth of SMEs in China's manufacturing industry.

1 INTRODUCTION

1.1 Research Background

As an important engine of development in the new era, the digital economy has flourished globally and become the backbone of promoting the intelligent development of society. China's digital economy has seen continuous expansion, hitting 53.9 trillion yuan in 2023, which represents 42.8% of the country's GDP. This underscores the critical role the digital economy plays in the national economy. The scope of influence of the digital economy is not only limited to the rise of new industries, but it significantly affects the way traditional industries operate, how they produce goods, and how their value chains are organized. The core of the digital economy lies in data, which is regarded as a key production factor, and the deep integration of digital technology and the real economy is realised through modern information networks. This integration drives the development and change of production and lifestyle towards unprecedented areas, and becomes a powerful driving force for stable social development.

The manufacturing sector has emerged as a new avenue for development for manufacturing enterprises as a result of the rapid advancement and widespread application of information technology, including big data, cloud computing, the Internet of Things, and artificial intelligence. Since China's economic opening and reform, the manufacturing sector has grown exponentially, serving as the backbone of the country's economy and playing a crucial role. However, with the weakening of the demographic dividend advantage, rising resource costs, coupled with the intensification of international competition, resulting in China's traditional manufacturing industry's living space has been squeezed. In this environment, enterprises urgently need to seek new production dynamics and development paths. The Chinese government and businesses are implementing a number of initiatives to encourage the digital transformation of the industrial sector in order to address this challenge. The Chinese government has clearly proposed in the strategic plan of Made in China 2025 to focus on building a green manufacturing system, placing innovation at the core of the overall development of the manufacturing industry, and leveraging the advantages of the digital economy in order to optimise the upgrading of the manufacturing structure, which is not only a strategic need to create a new competitive advantage for the digital manufacturing industry, but also an important issue for the realisation of the country's high-quality development.

1.2 Research Significance and Research Method

Even while the digital economy offers manufacturing companies a favorable environment in which to undergo digital transformation, SMEs continue to face numerous risks and obstacles in their quest for digital transformation. SMEs are important and irreplaceable in the economic system, and thanks to their large number and wide coverage, they are an important source of economic vitality. Due to their smaller size, manufacturing SMEs tend to be more flexible and responsive than larger firms. Therefore, studying the innovation and transformation of manufacturing SMEs can not only quickly identify and solve problems, but also promote the overall progress of the manufacturing industry and drive the development of the whole industry. Future research must focus on one of the main problems: how to encourage businesses to become digital while making sure SMEs profit and participate fairly?

Based on this, this paper summarises the current demand for transformation of manufacturing enterprises through literature combing and the driving benefit mechanism brought by the digital economy, explores the positive effect of digital economy development planning on the transformation of manufacturing SMEs, highlights the essential elements of the digital economy that support businesses' transformation processes, and deeply analyses the risks existing in the process of digital transformation, and explores relevant countermeasures and recommendations, to encourage the evolution of the manufacturing sector and sustainable development by providing theoretical support, and to draw attention to China's digital economy background of small and medium-sized manufacturing enterprises transformation related research.

2 TRANSFORMATION NEEDS OF MANUFACTURING ENTERPRISES AND DRIVING EFFECTS OF THE DIGITAL ECONOMY

2.1 Dilemma and Innovation of Manufacturing Enterprises

Studies have shown that R&D expenditures of enterprises should account for at least 2 to 4 per cent of turnover in order to ensure sustainable development and market competitiveness. However, many enterprises in China currently spend less than 1 per cent of their turnover on R&D, a phenomenon that severely hampers innovation and limits their market adaptability. The total amount of R&D funding at the national level is also insufficient, further limiting the innovation capacity of manufacturing enterprises. In addition, Chinese enterprises have a relatively single source of funding structure, relying mainly on internal inputs and credit funds, while venture capital and stock market funds account for a small proportion. The limitations of this funding structure can lead to a lack of flexibility and diversity in the introduction of innovative technologies, which can easily lead to the loss of the opportunity to enhance innovation capacity due to a lack of funds, or the conservative performance of R & D investment, which can be hampered in the process of long-term development. At the same time, Chinese manufacturing enterprises also face problems such as insufficient investment in technology level and aging production equipment, which further reduces production efficiency, raises operating costs, and further erodes product quality and competitiveness, diminishing the marketability of companies.

To solve this dilemma, several alternatives to the enterprise innovation strategy have been proposed by domestic and international academics. Noni Ngisau and Nurhani Aba Ibrahim (2020), from Malaysian manufacturing enterprises, found that government support can regulate the promotion of enterprise innovation. Jing et al. (2021), on the other hand, used fsQCA analysis to prove that lean digitisation in the Jing et al. (2021) used fsQCA analysis to demonstrate that the differentiated implementation paths of Lean digitalisation in the 'point, line, surface and body' phases can help firms to allocate and utilise resources in a more rational way.

2.2 Driving Mechanisms of Digital Transformation

The change of digital technology not only promotes the intelligent change of manufacturing enterprises, but also promotes the significant improvement of enterprises in terms of operational efficiency. Academic research on digital drivers mainly focuses on the economic and technical dimensions, but in recent years, scholars have gradually explored the influencing factors of digital transformation and its driving mechanism from multiple dimensions. Jun Jin et al. (2020) discuss cases from the technological dimension, organisational dimension and

environmental dimension, and propose a synergistic evolutionary relationship between them and digital transformation. While Stentoft et al. (2020) showed in their study that policy support can help firms to improve the level of awareness and thus enhance the recognition of opportunities due to technology facilitation. Zhao Qingqing and Li Siqi (2023) argued that digital transformation evolves synergistically with corporate strategy and organisational model in a dual-path dynamic that provides a power source for corporate innovation. From the strategy of 'smart change and digital transformation', Peng, Yan (2023) provided a dual internal and external driving mechanism and clarified the fundamental connection between digital transformation and intelligent transformation of SMEs.

The digital transformation of industrial firms is being propelled by a multitude of intricate elements. Manufacturing companies' ability to adapt quickly to changes in the market in a highly competitive environment is made possible by the interplay of organizational change, policy support, technological advancement, and other factors. These factors collectively propel the process of digital transformation in manufacturing companies.

2.3 Enabling Role of the Digital Economy

According to the data released by the 'Analysis

Report on the Status of Digital Transformation of China's Micro, Small and Medium-sized Enterprises', after launching digital transformation, enterprises saw a significant increase in production or operational efficiency as well as business revenue. Among them, 85.24% of the enterprises in the sample saw their production or operational efficiency increase by more than 5% after undergoing digital transformation; 68.28% of the enterprises in the sample saw their revenue increase by more than 5% during the same period. This shows that accelerating digital transformation is an inevitable choice for MSMEs to get rid of difficulties and enhance competitiveness. The relevant data can be seen in Figure 1.

It is easy to see that the development and deployment of artificial intelligence plays a crucial role in helping businesses achieve digital transformation in the real-world application of the digital economy. The digital economy provides a strong enabling role for manufacturing enterprises, through big data, industrial Internet of Things and other advanced technologies, to promote the enterprise in decision-making, production efficiency, market adaptability of the three aspects of the improvement. Vice versa, the manufacturing environment provides a huge opportunity to make better decisions using AI technologies (Sharma et al, 2021), according to McKinsey, 40% of all potential value that can be created by today's businesses
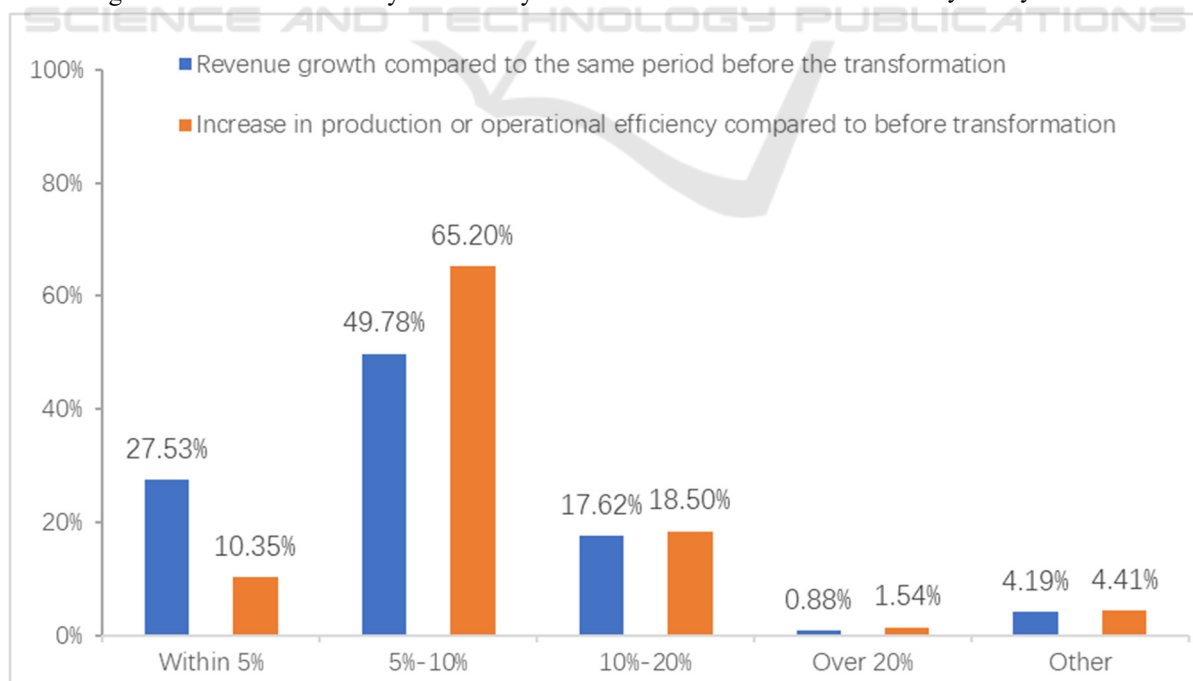
Data from: China Association of Small and Medium Enterprises

Figure 1: Production or operational efficiency and revenue growth after digital transformation.

comes from AI and machine learning technologies, which shows the key role of AI in business innovation and value creation. Rai et al. (2021) proposed the Industrial Internet of Things (IoT) as a key enabler in the manufacturing environment, facilitating AI to utilise big data for real-time monitoring applications. The digital economy enables firms to effectively utilise data-driven decision support systems (Sahu et al,2021), which can lessen the negative effects of market volatility and boost firm resilience by assisting businesses in adapting swiftly to changes in the market.

The digital economy provides manufacturing firms with a wealth of tools to help improve productivity and resource efficiency, which enhances firm competitiveness while promoting sustainable development. Henfridsson et al. (2018) suggest that for SMEs, digital infrastructure facilitates the optimal allocation of digital resources and the creation of new value by integrating software and hardware components. Liu et al. (2023), on the other hand, explored that digital tools can significantly enhance SMEs' digital capabilities, reduce associated costs, and play an important role in improving productivity. Huang Hao et al. (2023) study the digital platform capability of manufacturing SMEs, and propose to combine the current resources of enterprises with new digital technologies, so as to optimise the hardware

configuration of enterprises and fully release the facilitating effect of digitalisation on innovation output.

3 RISKS AND CHALLENGES OF DIGITAL TRANSFORMATION IN MANUFACTURING SMES

For manufacturing SMEs looking to increase their competitiveness and achieve sustainable development, digital transformation has emerged as a critical route. However, according to the findings of China SME Digital Transformation Report 2024, it is not difficult to find that although the vast majority of SMEs have started digital transformation, they are still in the early stage of development and face many risks and challenges. The data shows that 98.8% of SMEs have started digital transformation, of which about 32.8% have only tried digital applications in a single scenario; about 30.6% have carried out partial digital construction within the value chain; and the proportion of SMEs with a higher level of digitisation, driven by intelligence, is only 3.2%. As shown in Figure 2.

DIGITAL TRANSFORMATION PROCESS FOR SMES
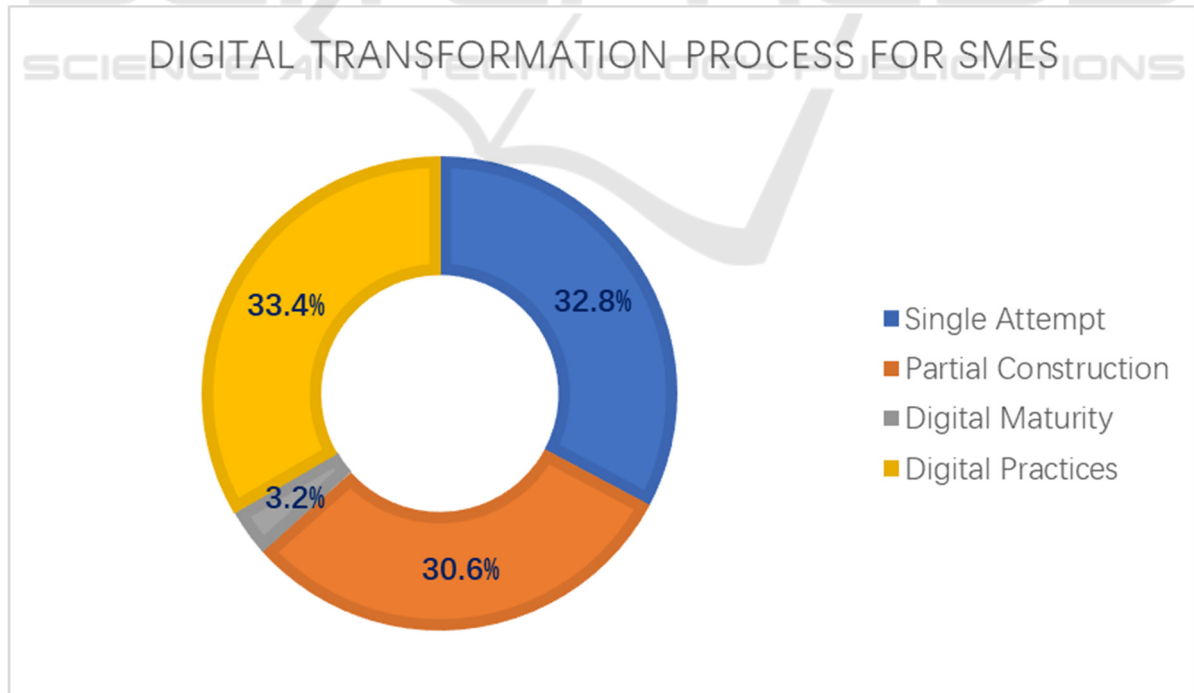
Data from: 36 Krypton Research Institute

Figure 2 Digital transformation process in SMEs.

With the rapid development of intelligence, the current Chinese SMEs have a strong willingness to digital transformation, but still 60% of enterprises are still in the early stage of development. In terms of industry distribution, compared with the Internet, finance and other industries with better infrastructure, the manufacturing sector is undergoing a slower and more difficult digital transition. Overall, the digital transformation of SMEs is still in the exploration stage, and there are still certain risks and challenges.

3.1 Digital Divide and Technology Gap

In the digital economy, there are significant differences between SMEs and large manufacturing enterprises in terms of their access to technology, their ability to apply it, and the benefits of digitisation, creating a 'digital divide'. Large manufacturing enterprises are more likely to succeed in digital transformation due to their strong financial and technological resources, and they invest in new technologies to achieve digital innovation to maintain their competitiveness in the market in a changing economic environment, while SMEs encounter more obstacles in the transformation. Due to limited financial resources, SMEs lack sufficient capital to bear the high costs of technology investments and upgrades.

Digital transformation requires a large amount of initial capital to upgrade existing equipment, introduce new technologies, and set up information systems, and these investments may not immediately improve business performance or generate direct returns in the short term. This investment risk is huge for SMEs, and if digital transformation fails to deliver the expected returns, the enterprise may experience greater financial pressure or even affect normal business operations. The lack of ability of SMEs to innovate results in a greater challenge for them to stay ahead of the curve in the digital economy. This widens the gap between SMEs and large corporations and hinders the digital transformation of the manufacturing sector in general.

3.2 Insufficient Pool of Digitisation-Related Talent

Successful digital transformation relies not only on technology, but also requires talent with digital technology and data analytics skills. However, many SMEs have significant deficiencies in digital talent pool and retention, which seriously affects the effectiveness of digital transformation. In the manufacturing sector, the digitalisation process is usually led by middle managers who do not possess digital skills, and there is a lack of digital talent

capable of leading the change, leading to blind spots and shortcomings in the process of strategy development and implementation, essentially creating a clear disconnect with digital change. This shortage of talent leaves companies with more than they can handle in the digital transformation process. In addition, due to limited resources, SMEs are usually unable to offer salary packages, training opportunities and career paths comparable to those offered by large enterprises, making it difficult to retain digital talent for long periods of time, even if they are able to recruit it. This turnover of talent increases the time and capital costs of business transformation, undermining its long-term sustainability.

3.3 Lack of a Complete Digital Transformation Strategy and Framework Support

The primary obstacle to an enterprise's ability to undergo digital transformation is that it 'does not have the support of complete digital transformation strategies and frameworks', according to the 2023 China Association of Small and Medium Enterprises (CASME) publication, 'Analysis Report on the Digital Transformation Status of China's Micro, Small and Medium Enterprises', which means that SMEs often lack a clear direction and systematic planning when they formulate and implement their digital transformation strategies. Clear direction and systematic planning. In the face of a fast-changing market, they are often prone to strategic shortsightedness.

From an internal governance perspective, businesses are unable to closely align their digital transformation strategy with their long-term development plan because they do not have a thorough understanding of the meaning and implications of digital transformation; limited by the cognitive limitations of the management and the shortage of internal resources, it is difficult for SMEs to form a logical and clear framework for the implementation of digital transformation, which leads to the irrational allocation of resources and weak implementation when implementing the strategy. This leads to irrational allocation of resources and ineffective implementation.

The complexity of the manufacturing industry's transformation, the non-replicability of the successful cases that have already been established, and the external environment's perspective all contribute to SMEs' lack of forward-looking macro-environmental prediction and their inability to make timely adjustments to the strategic direction of digital

transformation. This tendency of SMEs to prioritize the short-term results of the fast digital strategy severely limits the sustainability of the transformation.

4 COUNTERMEASURE SUGGESTIONS FOR THE TRANSFORMATION OF MANUFACTURING SMES

4.1 Bridging the Technology Gap

In response to the lack of technical resources, SMEs can adopt flexible and low-cost digitalisation tools. In this way, they can reduce the investment cost in the early stage of transformation, shorten the implementation cycle, and enable enterprises to achieve rapid transformation in the early stage of transformation, so as to accumulate digital experience and gradually enhance the depth of digital transformation. In addition, SMEs should make full use of the current government support policies at the financial level, such as loan subsidies, loan guarantees, risk compensation and other services, increase investment in the technical level, actively apply for special government funds, and take advantage of the policy advantage to reduce the cost of digital transformation investment and improve risk response capabilities, so as to bridge the existing technological disadvantages.

4.2 Optimise Talent Introduction and Training Mechanisms

SMEs should pay attention to the cultivation of internal talents, enhance the quality of existing employees through regular training, and improve the digital ability of employees; at the same time, they should maintain friendly relations with scientific research institutes and high efficiency, and through the signing of university-enterprise cooperation agreements, while realising the interaction of human resources, they should combine the job requirements of enterprises with the objectives of talent cultivation in universities, so as to achieve the effect of seamless connection between the cultivation of talents in universities and the demand of talents in enterprises, and to convey the Fresh digital talents.

In terms of compensation system, in the case of insufficient internal resources, the company has set up equity incentive mechanism for high-end technical talents, and at the same time, provided clear career promotion paths to enhance the sense of belonging of talents, and to a certain extent, reduced the turnover rate of talents.

4.3 Clarify Strategic Planning for Digital Transformation

In order to achieve the dual goals of improving internal efficiency and adapting to the external environment, companies should think about strategic planning from two dimensions, internal and external, respectively, so as to better formulate and implement digital transformation strategies. As shown in figure 3.
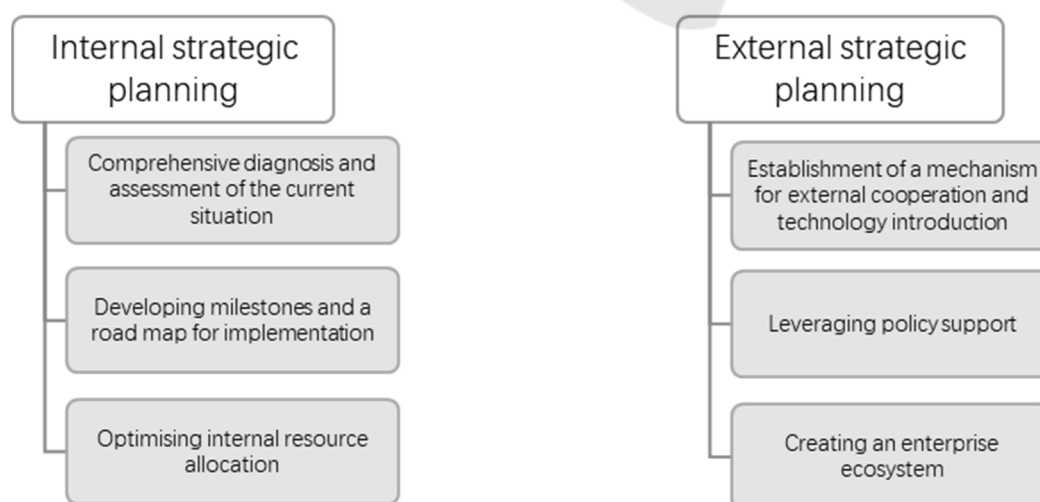

Figure 3 Internal and external strategic planning.

SMEs conduct a comprehensive diagnosis from the internal level, assess the existing level of digitization, identify the strengths and shortcomings of the enterprise, set milestones based on the actual situation of the enterprise, and specify the resource allocation and implementation steps for each stage, while introducing digital tools and management platforms to improve the level of management and push the enterprise towards a data-driven intelligent operation mode. At the external level, SMEs should actively seek the support of external technology providers, scientific research institutions and industry alliances through technology introduction, resource sharing and joint research and development. Enhance their own technology development level, shorten the transformation cycle, and gradually establish enterprise ecosystems through cooperation with friends to promote resource integration and enterprise win-win.

5 CONCLUSIONS

The results of the study show that the digital economy provides unprecedented opportunities for the survival and development of SMEs, especially in improving productivity, optimizing resource allocation and enhancing enterprise resilience, but at the same time, the lack of resources in terms of technology and capital restricts the equal competition with large enterprises in the process of digital transformation. This paper identifies and analyzes the risks that may be encountered in the digital transformation of SMEs, and puts forward targeted recommendations to provide transformation ideas for manufacturing SMEs from three dimensions: bridging the technology gap, optimizing the talent cultivation mechanism, and clarifying the strategic plan to help narrow the gap between SMEs and large-scale enterprises, which to a certain extent solves the problem of SMEs' fair participation in the market competition. However, as this paper mainly researches through literature combing and case study analysis, lacking field investigation and empirical analysis, there are certain limitations in the universality of research conclusions; in addition, this paper focuses on exploring Chinese manufacturing SMEs, and has not yet analyzed in-depth the differences between SMEs in different countries and regions in terms of digital transformation.

Based on this, future research can start from the data and construct relevant empirical analysis models, so as to more comprehensively identify and analyze potential risks and countermeasures, and guide more manufacturing SMEs on the path of digital transformation. In addition, drawing on successful cases of digital transformation around the world, the formation of a cross-country comparative research framework for the digital transformation path of China's manufacturing enterprises has an excellent guiding role, and better help enterprises to develop transformation strategies in accordance with local conditions and time. Digital transformation is a strategic move toward sustainable development as well as a crucial tool for businesses to increase their competitiveness. It affects not just the growth and survival of certain businesses but also significantly influences societal stability and economic expansion. Future research should focus on how to ensure that businesses in the digital economy are fairly able to benefit from technological advancements.

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