

Empirical analysis of digital transformation of smes

Xiaohui Wei

Yellow River Conservancy Technical Institute, Kaifeng 475004, China

Abstract: This study takes small and medium-sized enterprises as the research object, based on the exploration of existing scholars, uses the perspective of configuration to match TOE framework, and builds an integrated analysis system. Using the Typical Case Set of “Chain” digital transformation of Small and medium-sized enterprises (2022), 20 chain digital transformation enterprises are selected as samples, and based on the three dimensions of TOE theory, Applying fsQCA method and configuration thinking mode, different main conditions are configured with each other to form a configuration of sufficient and necessary conditions, analyzing the actual cause and effect of the digital transformation of smes, and exploring the drive of different mechanisms of multiple concurrent factors in depth. It is expected that the results of this study will provide some management enlightenment for smes and provide practical reference for practitioners and managers to formulate matching digital transformation routes based on their own situations.

Key words: Digital transformation; Fuzzy set configuration analysis

1. Research background

To promote the healthy development of China’s digital economy, it is necessary to grasp the development trend and rules of digital economy. The digital economy needs to run through the vein of traditional industries and the real economy. From restructuring production factors to institutional innovation, from building management concepts to optimizing commercial marketing, from integrating business forms and structures to refining organizational frameworks, it needs all-encompassing innovation. In the 14th Five-Year Plan for Digital Economy Development, it is clearly proposed to vigorously promote the digital transformation of industries and implement special actions to empower small and medium-sized enterprises. In China, small and medium-sized enterprises are the new force of national economic and social development. Faced with a complex and changing international and domestic economic environment, these potential enterprises are faced with numerous challenges. In order to break through the difficulties, the digital transformation of smes is the foundation of the healthy development of the digital economy and the root of the long-term economic and social development. Digital transformation is not a “choice” but an “inevitability”.

2. Research and design

2.1 Research Methods

This paper aims to interpret the feasibility path of digital transformation of smes by means of multi-factor analysis of configuration effects. As mentioned above, QCA method is a research method of complex problems with “multiple causes and complications”, which is a very suitable choice. The configuration analysis in the above step 5 can present the results from an overall perspective, observe the analysis results of the intermediate solution, study the causal relationship between the configuration and the results under multiple conditions of technical dimension, organizational dimension and environmental dimension, and analyze the advantages of qualitative data processing, limited diversity and simplified configuration with the help of truth table and the characteristics of high data precision and quantitative and qualitative. To a certain extent, it breaks through the limitations of traditional measurement methods such as regression.

2.2 Selection of conditions

Under the TOE framework, this study selects four elements, namely, digital foundation, digital operation, digital management and digital effectiveness, according to the characteristics of digital transformation of selected cases, based on the technical dimension, organizational dimension and environmental dimension, to analyze the endogenous logic and necessary configuration of successful digital transformation of smes.

2.3 Data collection and case determination

Entrusted by the Bureau of Small and Medium-sized Enterprises of the Ministry of Industry and Information, the China Industrial Internet Research Institute and the National Industrial Information Security Development Research Center summarized and accepted all the application materials, organized expert review, and selected 34 cases. Compiled the Collection of Typical Cases of “Chain” Digital Transformation of Small and medium-sized Enterprises (2022), and summarized and refined four typical “chain” transformation models: technology enabling model, supply chain enabling model, platform enabling model and ecological enabling model. The four models are all different ideas through the chain transformation, and there is no distinction between higher and lower. Therefore, this study follows the case selection principle of QCA method, and finally determines 5 cases of technology enabling mode, 5 cases of supply chain enabling mode, 5 cases of platform enabling mode and 5 cases of ecological enabling mode to avoid the consistency of industrial characteristics caused by excessive repetition of similar development modes in the cases, and different negative energy mode selection can ensure the heterogeneity of cases. The selected cases are typical, representative and effective driving enterprises of digital transformation, which can reflect the overall sufficient homogeneity. In this study, the characteristics of these enterprises with different abilities but successful transformation are summarized into four aspects: digital foundation, digital operation, digital management and digital effectiveness.

2.4 Calibration of conditions and results

Calibration is a process in which a case is assigned a set of specific conditions. In this study, fuzzy set calibration was adopted, SPSS software was used to describe the statistical frequency, and then FSQCA software was used for calibration. The calibration results are shown in Table 1 below.

Table1 Describe the frequency of statistics

statistics		VAR00001	VAR00002	VAR00003	VAR00004
Number of cases	Effective value	20	20	20	20
	Missing value	0	0	0	0
Percentile	5	78.1000	78.0000	68.0500	76.0000
	50	84.0000	83.5000	78.5000	82.5000
	95	90.0000	88.9500	88.8000	86.9500

Data calibration was carried out according to the standards of 95% (fully in) 5% (fully out) and Crossover Point proposed by Ragin. This study obtained the results after calibration through the relevant data of the statistical frequency table.

3. Empirical analysis and conclusion

3.1 Analysis Results

fsQCA4.1 was adopted to analyze the sample data. According to the standard analysis of the truth table, three kinds of results emerged, namely complex solution, intermediate solution and reduced solution. The main reference was the intermediate solution which removed the logic terms, that is, the contradictory configuration, and took the largest combination of cases into account. Finally, three configurations for the successful digital transformation of smes are obtained (see Figure 1). The Consistency of the single solution is all higher than 0.9, which shows that each configuration after matching can lead to the success of the transformation and is the necessary condition for the realization of digital transformation. The Consistency of the overall solution is 0.95625, indicating that in the selected cases of small and medium-sized enterprises, 95.625% of enterprises have basically completed the digital transformation and achieved performance improvement under the conditions of meeting the above two configurations. In addition, according to the analysis of the coverage index of Solution coverage, the overall coverage reached 85.0788%. We can see that the two configurations obtained from the results jointly explain the general path for smes' digital transformation to reach the period of digital intelligence innovation, and each configuration has substantial explanatory power and universal applicability for digital transformation.

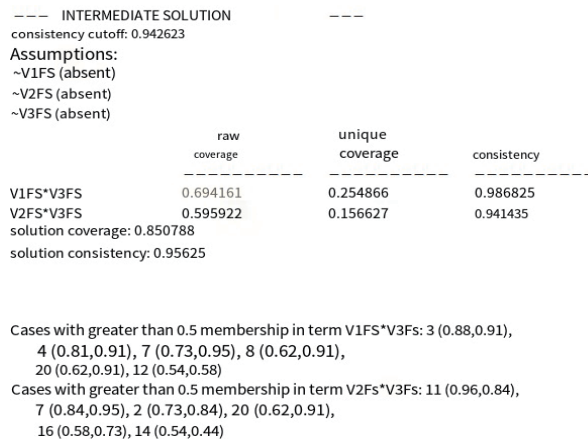


FIG. 1 Results of conditional configuration analysis

3.2 Research conclusions and suggestions

According to the results of configuration analysis, two configurations, V1FS and V3FS, V2FS and V3FS, can be obtained. According to the anthems correspondence and their logical characteristics, this study further summarizes and analyzes to help identify the differences between different transition paths:

(1) all-factor integrated drive type. Digital transformation requires a well-defined overall layout and efficient order, and a clear logical relationship between levels, involving hardware and software infrastructure investment, core business process optimization, organizational structure adjustment, digital talent training and other aspects, so the successful digital transformation of small and medium-sized enterprises, Depending on their own conditions and ecology, they can realize digital transformation through digital infrastructure construction, digital operation integration, and digital management sharing. Enterprises with the driving force of all-factor digital transformation must pay attention to the risk management of information security. According to the data, 88% of enterprises have established information security

systems, 45% have developed security management for industrial computer, and 20% have border protection capabilities for industrial control networks. Therefore, protecting key digital assets from external threats and improving the robustness of business operations have been recognized by more and more enterprises, but their security protection capabilities and actual implementation are not in place. As the process of digitization continues to accelerate, the risks of data leakage and network security have multiplied, and information security construction should be strengthened, comprehensive risk management should be carried out to ensure the stable operation of organizations.

(2) Infrastructure -- digital management-oriented. Limited by all kinds of resource constraints, small and medium-sized enterprises as a whole show a low level of digital transformation. In the tide of digital transformation, it is urgent to change the concept in time and identify the value incision. Most small and medium-sized enterprises in China do not have independent research and development and product design capabilities, and only participate in the global industrial chain activities as a supporting party of production and manufacturing, which has a low threshold of production and manufacturing, fierce competition and thin profits. The lack of independent digital research and development design. Most enterprises have initially applied digital tools, but there are still large deficiencies in the depth of application of digital tools and the degree of cross-departmental sharing of product design data. Simulation optimization and data sharing are the key to improve product design quality and shorten the research and development cycle. The second half of product digital transformation needs to pay attention to product simulation optimization and data sharing application.

The digital transformation of small and medium-sized enterprises can not be facilitated by a single factor, but requires a variety of factors to coordinate the configuration. The two configurations analyzed in the research work together on the successful digital transformation of enterprises, with the characteristics of "multiple concurrency". Comprehensive analysis of the above three driving types:

Small and medium-sized enterprises should actively apply the standards of "Digital Transformation Guide for Small and medium-sized Enterprises", focus on the core and focus, and customize the specialized and special new development road with high product innovation, high management change ability, and strong business optimization ability for scene applications.

The government and relevant digital management departments should promote the grading evaluation of service capabilities, select a group of digital transformation service providers by industry and field, and promote the effective improvement of service levels. At the same time, we should focus on industrial clusters, industrial parks and other key areas to explore the mode of government, industry, research and service cooperation, and encourage more high-quality service resources to reach enterprises.

Leading enterprises and third-party service platforms should give full play to the technical capabilities of industrial Internet platforms, develop scenario-based digital solutions with relatively low cost of popularization and more convenient and concise use, and help small and medium-sized enterprises to digital transformation.

For start-up smes, increasing investment in IT infrastructure is the key to improving their viability. In the future, some start-up smes will develop into growth smes, and the key is to lay a solid foundation for digital office, digital management and data management. For a long time in the future, start-up small enterprises should increase their investment in digital IT basic software and hardware, including all kinds of servers, terminal PCS, databases and CRM management software. In the future, only by increasing the investment in IT infrastructure can the start-up small enterprises realize the steady development of business, and only by relying on the empowerment of digital technology for business, it is possible to realize the curve overtaking.

For growing smes, data value mining and digital operation and management are the prerequisite for achieving dynamic management and control in the face of business scale growth. The future growth of small enterprises will be very likely to develop into medium-sized enterprises, but the logic of business growth is not only to rely on linear increase in the number of orders, but also to rely on business application innovation based on digital technology. With the increase in the number of orders and customers, the ability to manage data will become a key factor in determining whether a growing small enterprise can develop into a medium-sized enterprise. In the future, growing small enterprises will achieve technological breakthroughs in data integration system, data source application, data asset management and data service system, and rely on big data storage and computing platforms to support the upper data application system, so as to meet the needs of dynamic business growth.

References

- [1] Meiling Yang. Research on the dilemma and countermeasures of SME development under the new Situation [J]. Fortune Today, 2020(24):33-34.
- [2] Acquah Innocent Senyo Kwasi; Quaiocoe Judith; Arhin Michael. How to invest in total quality management practices for enhanced operational performance: findings from PLS-SEM and fsQCA [J]. The TQM Journal. Volume 35, Issue 7. 2023. PP1830-1859.
- [3] Liang Ma, Haolin Hu, Yaning Li. Exploration of digital transformation path for smes -- Based on NCA and fsQCA methods [J]. Journal of Finance and Accounting, 2023, 44(17): 152-160.
- [4] Jun Liu. Research on Digital transformation of Small and medium-sized enterprises [J]. Cooperative Economy and Technology, 2023(22): 86-89. (in Chinese)
- [5] Xin Zhang, Yaoyu Xu, Liang Ma. Research on the configuration effect of the influencing factors of SMEs' digital transformation [J]. economic and management review, 2022, 38 (1): 11.

Project: Research results of "Promoting Healthy Development of Digital Economy -- Empirical Study on Digital Transformation of Small and Medium-sized Enterprises" (2024-ZDJH-097), General Project of Humanities and Social Sciences Research in universities of Henan Province.