Research on the Influence of Digital Capability on Service Transformation of Manufacturing Enterprises*

Hailin Dong[1,a], Juhong Chen[1]

Email: donghailin123@163.com, Tel:18189503628[a]

School of Economics and Management, Xi'an University of Technology, Xi'an 710054, China[1]

Abstract: Digital capability is an important support for service transformation of manufacturing enterprises. But there is a lack of in-depth research on how to use digital capability to promote service transformation. Based on the dynamic capability theory, through the questionnaire survey of 215 manufacturing enterprises, this paper explores the internal mechanism of digital capability driving the service transformation of manufacturing enterprises by using the analytic hierarchy process and Bootstrap method. The research shows that:(1) digital capability promotes the service transformation of manufacturing enterprises, and resource flexibility and coordination flexibility play the full mediation effect;(2)More interestingly, of the effect size of different mediation paths, coordination flexibility has the strongest effect. The research conclusion not only presents a new theoretical explanation for the mixed findings on the relationship between digital capabilities and firm performance, but also provides a useful reference for the service transformation of manufacturing enterprises.

Keywords: Digital Capability, Resources Flexibility, Coordination Flexibility, Service Transformation.

1 INTRODUCTION

In recent years, with the development of digital technologies such as Internet of Things, big data and cloud computing, they have brought revolutionary power source to the service of manufacturing enterprises [1]. Driven by digital technology, the service business of manufacturing enterprises has been transformed from traditional experience-based passive response service to data-driven accurate prediction and intelligent decision-making service [8]. Digital capability is an important support for the service transformation of manufacturing enterprises in the era of digital economy [11]. By improving digital capability, enterprises constantly optimize processes, improve organizational agility [12], innovation capability and optimize human capital structure [24] to empower enterprise value creation. However, Kohtamäki (2020) believe that digital capability does not always improve organizational performance. Based on this, in digital economy, it has become an important research topic to clarify the action mechanism of digital capability on service transformation and promote the high-quality development of manufacturing enterprises.

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At present, the academic research on service-oriented manufacturing enterprises mainly focuses on organizational change and resource allocation [2], service innovation capability [21], service operation and maintenance business model innovation and other issues [3]. In recent years, with the increasing maturity of digital technology, the influence of digital technology on service has attracted the attention of some scholars. However, there is still a lack of research on how to use digital capabilities to drive the service transformation of manufacturing enterprises. Thus, this study takes 215 manufacturing enterprises that are using digital technology for service transformation as samples. Based on the dynamic capability theory, this study tries to open the "black box" between digital capability and service transformation performance of manufacturing enterprises from the perspective of strategic flexibility by using the analytic hierarchy process and Bootstrap method.

This study contributes to the existing literature in the following two aspects: First, based on the dynamic capability view, we explore the internal mechanism of digital capability driving the service transformation of manufacturing enterprises, and further enriching the related research of manufacturing service; The existing literature emphasizes the promotion of digitalization to enterprises' slight flexibility, but the research regards strategic flexibility as a whole, and does not distinguish the difference between resource flexibility and coordination flexibility. Through empirical analysis, this paper holds that coordination flexibility plays a more significant mediating role between digitalization capability and service innovation performance than resource flexibility. This discovery provides new guidance for the service transformation of manufacturing enterprises.

2 THEORY AND HYPOTHESES

2.1 Dynamic Capability View

Dynamic capability refers to the ability of perceiving and seizing new opportunities, reconfigure and protect knowledge assets, capabilities and complementary assets, so as to achieve sustainable competitive advantage. The organizations try to adapt to the new environment by identifying and capturing new strategic opportunities, coordinating necessary organizational assets, inventing new business models and organizational forms, changing business processes and restructuring resources [19]. In the digital economy, the reconstruction and integration of internal and external resources are promoted by embedding digital technology into organizations and processes, so as to promote the innovation of processes [9[. Digital capability reflects the perception dimension of dynamic capability to a certain extent. Resource flexibility and coordination flexibility are conducive to enterprises to seize the opportunity to reconfigure resources to cope with the uncertainty of the external environment.

2.2 Digital Capability and Service Transformation Performance

Digital capability refers to the ability of enterprises to reconstruct the existing resources, structure, value, boundaries and other factors through digital technology, and cultivate and construct the ability to transform the production factors of digital economy into business model innovation in the process of digital transformation [17]. It mainly includes digital perception capability, digital operation capability and digital collaborative operation capability [22]. LI et al. (2022) think that enterprises with digital capabilities can strengthen the dynamic scanning of

the external environment through new digital channels (e.g., digital platforms, digital systems, etc.),perceive the changes of external environment and consumer demand in time, seize opportunities in time through market capitalization agility and operational adjustment agility, and reconfigure existing resources and processes to improve enterprise performance. Lenka et al. (2017) deconstruct the digital capability into three dimensions: digital intelligence, connection and analysis. We can give full play to the role of customer value supply to realize enterprise value co-creation through the perception and response the customers. Hence, we propose the following:

Hypothesis 1. Digital capability positively affects the performance of service transformation.

2.3 Digital Capability and Strategic Flexibility

Strategic flexibility refers to the ability of an enterprise to dynamically identify and respond to changes in the external environment in time to reshape organizational resources and strategies to improve its competitive advantage [14], including resource flexibility and coordination flexibility [18]. In the digital economy, more and more enterprises are speeding up the rapid integration of existing resources and business processes by cultivating their own digital ability, and improving the ability of enterprise resource integration. On the other hand, driven by the new generation of information technology, enterprises are more conducive to breaking the traditional organizational boundaries, and improving the circulation efficiency of resource elements and the flexibility of resource allocation through cross-border search in the R&D process; On the other hand, enterprises use artificial intelligence algorithms, mobile Internet and other digital technologies to explore new business channels, use the value network space to find key resources, and establish a flexible organizational structure, thus improving the flexibility of organizational coordination [15]; Some scholars also believe that in the turbulent market environment, the improvement of digital capability is conducive to the innovation of digital business model, which in turn affects the flexibility of enterprise strategy matching with the innovation of business model, thus realizing sustainable value acquisition and value creation, acquisition and value creation [4]. Accordingly, we postulate the following:

Hypothesis 2a. Digital capability positively affects resource flexibility.

Hypothesis 2b. Digital capability positively affects coordination flexibility.

2.4 Mediating Role of Strategic Flexibility

The dynamic capability view suggests enterprises with digital capability can dynamically perceive the changes of external environment, and improve their responsiveness to external environment by coordinating and integrating internal resources, processes and other elements. For example, Enrique et al.(2022) believe that enterprises with digital capabilities can use big data, Internet of Things and other technologies to improve the flexibility of internal supply chain operation, realize the operational efficiency of products from production to delivery, and improve operational performance. Toorajipour et al.(2021) think that enterprises can use machine learning, big data, cloud computing and other methods to strengthen the dynamic monitoring of the whole product production process, predict the future customer behavior, shorten the delivery time and reduce logistics costs. At the same time, the use of artificial intelligence technology makes the coordination between suppliers and distributors more flexible. However, only relying on digital capabilities to obtain external data can't directly help

companies improve their performance, the organizations need to be able to flexibly identify opportunities and adjust and restructure existing business processes, so as to promote the growth of enterprise performance [12]. Strategic flexibility is just such an ability to adapt to the changes of market demand through the flexible allocation of resources, the adjustment of organizational elements and processes. Hence, we pose the following:

Hypothesis 3 Strategic flexibility mediates the relationship between digitalization ability and service transformation performance.

3 METHODS

3.1 Data Collection

Before the formal distribution of the questionnaire, this study learned through a series of interviews that the managers of manufacturing enterprises such as digital department, information management, data application and R&D department can become potential research objects of this study, and they can deeply participate in big data management and service innovation. A total of 435 questionnaires were distributed. After eliminating invalid questionnaires such as similarity, obvious errors and short filling time, 215 valid questionnaires were finally obtained, with an effective recovery rate of 49.4%. The samples were mainly from Guangdong, Zhejiang, Shanxi, Fujian, Jiangsu and other places.

Table 1 Profiles of the sample. (N=215)

Item	item description	sample	percentage
Establish years	＜5years	49	22.70%
	6-10 years	63	29.08%
	11-15 years	44	20.57%
	＞16 years	59	27.66%
Scale	100 ≤ Size<500	65	30.26%
	500 ≤ Size<1500	78	36.41%
	1500 ≤ Size	72	33.33%
Ownerships	State-owned	49	22.70%
	Privately owned	97	44.92%
	Foreign	26	12.06%
	Others	43	20.33%

3.2 Measures

In order to ensure the validity of the measurement, all variables adopt the mature scale, which is revised and formed into the initial scale after translation and back translation. Through a small sample test of EMBA and MBA students in our school, some expressions in the initial scale are revised and adjusted according to the collected 52 questionnaires and the relevant feedback of the respondents, and finally the measurement scale is determined. Each variable item is evaluated by Likert5 scale. Among them, the digital capability reference to the scales of Lenka

et al(2017).Strategy flexible reference to the scales of Sanchez(1995),Yang(2015);Service innovation performance refers to the scales of Oliva et al.(2012),Feng(2020).Control variables include: the time, scale, industry and ownership form of the enterprise.

3.3 Reliability and Validity

In terms of reliability, Cronbach's Alpha coefficients of digitalization ability, resource flexibility, coordination flexibility and service transformation performance are 0.921,0.853,0.889 and0.910, and the combined reliability CR is 0.923, 0.854,0.890 and 0.876, which are all higher than the good threshold level of reliability test 0.8.In terms of validity, the factor load of each item exceeds 0.7,and the mean variance extraction (AVE) is greater than 0.65,which indicates that the questionnaire has high convergence validity. We test the structural validity of the model and the distinguishing validity between variables by selecting χ^2/df, RMSEA, SRMR, CFI and TLI indicators. Table2 shows that the questionnaire has good discrimination validity.

Table 2 CFA verifies the discriminant fitting index

Model	Factor	χ^2/df	RMSEA	SRMR	CFI	TLI
Four-factor model	DC, RF, CF, STP	1.29	0.03	0.03	0.98	0.98
Three-factor model	DC,RF+CF,STP	2.91	0.07	0.05	0.89	0.88
Two-factor model	DC,RF+CF+STP	3.90	0.08	0.07	0.83	0.81
Single-factor model	DC+RF+CF+STP	6.46	0.11	0.10	0.68	0.65

Note: DC, RF, CF, STP respectively represent digitalization capability, resource flexibility, coordination flexibility and service transformation performance. "+"means factor model merging.

3.4 Common Method Bias

The statistical method of Harman single factor test is adopted to test, and the variance interpretation rate of the largest factor is 21.791%, which is less than 40%, indicating that there is no obvious common method deviation problem.

3.5 Hypothesis Testing

From Table 3,It can be seen that first, digital capability has a significant positive impact on resource flexibility(β=0.434,P<0.001,and coordination flexibility (β=0.530,P<0.001.The results support Hypotheses 2a and 2b.Second,Digital capability (β=0.411,P<0.001)has a significant positive impact on service transformation performance when there are no presumed mediators. Model 4 is the whole model after adding the intermediary variable of strategic flexibility, and only the regression coefficient of resource flexibility (β=0.292, P<0.05) and coordination flexibility (β=0.435, P < 0.01) is significant, however, such a positive association becomes non-significant(β=0.203,P>0.10) when the presumed mediators exist. The above results thus confirm the full mediation effect of resource flexibility and coordination flexibility. To ensure robustness, **Table 4** reveals the results derived from the bootstrap method. Because the 95 % confidence interval of the direct path includes zero, whereas the 95 % confidence intervals of the two indirect paths exclude zero, these results confirm the full mediation effect of resource flexibility and coordination flexibility again. Overall, our results support Hypotheses 3.At the same time, the path difference between coordination flexibility and resource flexibility is 0.1029,and the confidence interval is [0.692,0.1815],excluding 0,which indicates that

coordination flexibility has a greater impact on different intermediary paths.

Table 3 Regression model and results

Variable	RF	CF	STP	
	Model1	Model 2	Model 3	Model 4
Establish years	-0.005	-0.086	0.016	0.061
Size	0.041	0.077	0.005	-0.026
Ownerships	-0.056	0.015	-0.012	-0.017
Industry	0.007	-0.005	-0.017	-0.031
DC	0.434***	0.530***	0.411***	0.203
RF				0.292*
CF				0.435**
R^2	0.240	0.300	0.282	0.450
F	21.95***	29.75***	27.26***	48.51***

Note: ***, **, and * represent significance at 0.001, 0.01, and 0.05 level, respectively.

Table 4 The effects of digital capability on service transformation innovation.

paths	Effect	BootSE	BootLLCI	BootULCI
DC→STP	0.073	0.046	-0.018	0.165
DC→RF→STP	0.1022	0.037	0.1196	0.2642
DC→CF→STP	0.578	0.034	0.0511	0.1234

4 CONCLUSION

Based on the sample of 215 manufacturing enterprises that are using digital technology for service transformation, this paper analyzes the mechanism of strategic flexibility between digital capability and service transformation of manufacturing enterprises by using the analytic hierarchy process and Bootstrap method. The results show that:(1)Digital capability promotes the service transformation of manufacturing enterprises, and resource flexibility and coordination flexibility play the full mediation effect;(2)More interestingly, of the effect size of different mediation paths, coordination flexibility has the stronger effect.

5 MANAGERIAL IMPLICATIONS

Based on the above conclusions, this paper puts forward the following suggestions: First, manufacturing enterprises should seize the opportunity of digital transformation and vigorously carry out digital capacity building. Accelerate the innovation and application of big data, artificial intelligence, and the mobile Internet in R&D, production, marketing and other links, and improve the digital operation capability. Second, give full play to the transmission function of resource flexibility and coordination flexibility between digitalization capability and service transformation. Build a big data platform or network, strengthen communication and

collaboration with stakeholders to form an innovation ecosystem, shorten the development process of new products or services, and thus improve service innovation performance.

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