



Research on the Influence of Network Management Capability and Knowledge Acquisition on Service Innovation Performance

— The Regulation of Environmental Dynamics

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ABSTRACT

In a rapidly changing business environment, service enterprises must meet the needs for service diversification and individualization by optimizing network relationships and resolving network conflicts. Although service innovation has attracted the attention of numerous scholars, the performance of service innovation through network management is relatively scarce. Through an in-depth study of small and medium-sized service enterprises in Xi'an High-tech Zone, a relational model is constructed with knowledge acquisition as a mediator, environmental dynamics as a moderator, and network management as service innovation performance. SPSS 18.0 software is used for data analysis, and AMOS 21.0 software performs structural equation model analysis of sample data. The results show that knowledge acquisition mediates network management and service innovation performance, and that environmental dynamics positively moderate network management capability and knowledge acquisition. This study provides a theoretical basis and management insights for service innovation activities in service enterprises.

Keywords: *network management capability; knowledge acquisition; environmental dynamics; service innovation performance*

1 Introduction

The years following the financial crisis have witnessed a more competitive market, rapidly changing technologies, shorter product life cycles, and diversified customer needs. In an ever-changing environment, the monotonous, linear service innovation model of enterprises can no longer meet the market demand and gradually evolves into a network-based innovation model. Networks have become an important environmental feature of service enterprises, and their formation, structure, and evolution will influence market competition ^[1]. The uncertainty and changeability of networks make it imperative for enterprises to manage networks. Network management helps enterprises leverage the valuable resources hidden in networks ^{[2][3]}, because it can create location advantages ^{[4][5]}, effectively resolve and mitigate network conflicts, optimize network relationships, and improve network subject quality and network management efficiency. At the same time, network management not only provides

access to valuable knowledge in networks but also has a direct influence on enterprise service innovation activities. The practice of economic development shows that knowledge is the key to creating value and increasing core competitive advantages for enterprises, and it is also the core element and resource that enterprises must contend for. However, the resources that many enterprises have in common are not advantageous resources for business competition, and only scarce resources can create unique competitive advantages for enterprises. Most of the scarce, innovative resources are scattered in network relationships ^[6], and the intricate knowledge, resources, and capabilities are an essential part of the service innovation process. Service innovation is to use these scarce, inimitable, irreplaceable knowledge resources to improve or reform existing services and related processes and acquire opportunities for sustainable development ^[7]. Therefore, in a dynamic network environment, enterprises can strengthen the research on network management capability to dynamically adjust

network locations, obtain network advantages, and exploit resources among network subjects for service innovation, thus providing continuous impetus for innovation [8]. Besides, such research enables enterprises to gain insight into the internal operation mechanism of networks to maintain stable and efficient operations. Network management is the lowest-cost way for enterprises to innovate services. In other words, proper network management can alleviate the bottleneck of resource scarcity in the service innovation process and reduce the risk of innovation failure. Hence, in a dynamic context, how network management influences service innovation performance has become a pressing issue in the current business and academic circles.

Most of the existing theories focus on the theoretical elaboration of network management, which enriches the network management system. However, there are relatively few empirical analyses. Due to the unpredictability and variability of the market environment, environmental factors have become essential concerns for the development of service enterprises. Pitifully, few scholars have investigated the influence of network management and knowledge acquisition on service innovation performance in a dynamic environment. Therefore, this paper studies the influence of network management on service innovation performance with knowledge acquisition as a mediator and environmental dynamics as a moderator. It is hoped that this paper can show the way for China's service enterprises to better enhance service innovation performance through network management and knowledge acquisition in a volatile market environment.

2 Theories and Hypotheses

2.1 Hypothesis of the relationship between network management capability and service innovation performance

Network management capability is the dynamic ability of enterprises to gain network advantages by performing network management tasks such as initiation, switching, coordination, and control. Enterprises with high network management capability are able to drive network evolution to superior locations and seize the initiative in networks, thus directly influencing the business and innovation activities. Besides, such enterprises can improve network management efficiency and bring network subjects closer, so that it is easier to reach a consensus about innovation goals and reduce the frequency and intensity of conflicts. High network management capability can bring location and control advantages, forming leading decisions for innovation activities. The improvement of innovation performance by identifying the value and hidden opportunities in networks also helps to cope with the impact of abrupt external changes and provides

enterprises with a relatively stable innovation environment. Therefore, the following hypothesis is proposed:

H1: Network management capability has a significant positive effect on service innovation performance.

2.2 Hypothesis of the relationship between network management capability and knowledge acquisition

Network management capability concerns entire networks and emphasizes the interaction between enterprises and networks [3]. It enables enterprises to access more distilled, high-quality information and tacit knowledge by enriching the links to existing resources through a higher central network location and expanding the resource base of enterprises. At the same time, the variability and unpredictability of the external environment make it necessary for enterprises to strengthen network configuration, dynamic adjustment, and external network optimization. As such, enterprises will introduce important technologies and knowledge to constantly update the internal knowledge base and acquire the latest tacit knowledge and resources. In addition, network management capability contributes to the development of collaborative network norms and facilitates the circulation of tacit knowledge. In this regard, with high network management capability, enterprises can timely and effectively deal with various network conflicts and create channels for knowledge circulation amid network relationships, so as to obtain good opportunities for knowledge sharing and technology transfer. Therefore, the following hypothesis is proposed:

H2: Network management capability has a significant positive effect on knowledge acquisition.

2.3 Knowledge acquisition and service innovation performance

In the era of the knowledge economy, knowledge acquisition capability is closely related to the development and even the survival of enterprises. Besides, the effective implementation of service innovation activities often requires intricate knowledge, capabilities, and resources. This necessitates enterprises to acquire knowledge and skills different from their own through various channels to expand their knowledge base [8], and accurately and quickly identify scarce, valuable knowledge from the complicated knowledge base, so as to take the lead in practicing service innovation ideas and improve the success rate of service innovation. The breadth of knowledge brings knowledge from different perspectives and fields and provides possibilities for combining innovative elements.

Meanwhile, the depth of knowledge better tells what customers want and need and help enterprises win new customers and improve their satisfaction and loyalty to gain more profits. Cassia and Colombelli ^[9] found that the generation of new knowledge in universities positively influences the growth rate of enterprises at a specific scale. Smith et al.^[10] believed that knowledge acquisition increases the stock of knowledge and, in turn, accelerates the introduction of new products. Therefore, the following hypothesis is proposed:

H3: Knowledge acquisition has a significant positive effect on service innovation performance.

2.4 Mediating role of knowledge acquisition

Knowledge acquisition refers to the gathering of valuable resources from the external environment by enterprises or their employees in the shortest possible time ^[2]. External networks provide tangible or intangible resource platforms, where enterprises and network subjects can properly communicate and coordinate with each other, so as to promote mutual understanding and trust among network partners ^[11]. They also alleviate the barriers to information sharing and integration among network partners and combine the advantages of internal and external network resources, thus expanding the space for service innovation activities. Moreover, high network management capability yields superior network locations ^[12], allowing enterprises to enjoy more advantages in collecting and processing new technologies. It leverages the resources and knowledge among other network subjects to influence the innovation performance of enterprises. Therefore, the following hypothesis is proposed:

H4: Knowledge acquisition mediates the relationship between network management capability and service innovation performance.

2.5 Moderating role of environmental dynamics

The dynamics of the business environment consist mainly of the diversification of customer needs, the shortening of product life cycles, and fierce market competition ^[13]. Although the business environment is unpredictable, it presents multi-level and multi-dimensional innovation knowledge, provides more opportunities for combining innovation elements, and creates new room for enterprise development. The more drastic the environment changes, the faster the technology renewal, the more diverse the customer preferences and behaviors, the greater the uncertainty, and the more frequent the changes in competitive strategies. That makes it necessary for enterprises to search for, acquire, and integrate external knowledge ^[14]. Network management serves as a creative way to resolve the problems and conflicts among network partners ^[15] and provides an in-depth analysis of such problems and conflicts, thus revealing inspiring expectations and solutions to innovation issues. Furthermore, high network capability can help enterprises get rid of unfavorable locations and create superior network locations. Therefore, the following hypothesis is proposed:

H5: Environmental dynamics positively moderate the relationship between network management and knowledge acquisition.

According to the above hypotheses, the theoretical model as shown in Figure 1 is constructed.

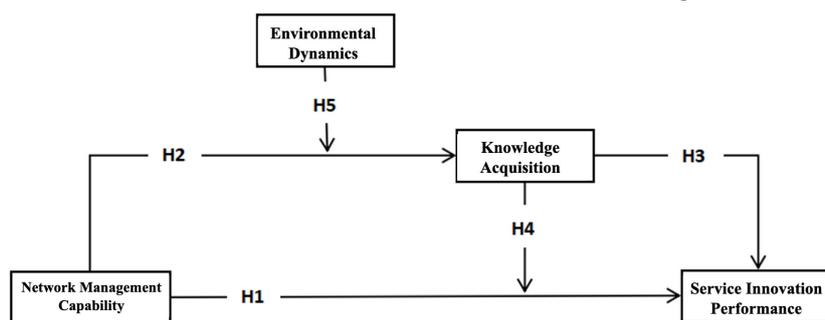


Fig. 1 Theoretical model of this paper

3 Research Design

3.1 Sample selection and data collection

This study adopted questionnaires, field visits, and in-depth interviews to investigate the service enterprises established since 2005 in the Xi'an High-Tech Zone. From September to December 2019, 450 questionnaires were distributed, and 357 were collected with an overall

response rate of 79.33%. After excluding incomplete questionnaires and invalid questionnaires with fictitious information or excessive default values, we obtained 282 valid questionnaires with a valid response rate of 78.99%.

The samples were mainly from five industries: e-commerce, logistics, information service, finance, and communications. E-commerce accounted for 25.89%, logistics 21.99%, information service 17.02%, finance

13.12%, communications 11.10%, and other industries 10.28%.

3.2 Variable measurement

The scale of this study was formed by fine-tuning the scales used in domestic and international published literature. The 5-point Likert scale was adopted, with 1-5 indicating: strongly disagree, disagree, neutral, agree, and strongly agree. Concerning network management, 4 measurement questions were formed by referring to and fine-tuning the scales proposed by Fan [11] and Zhu [19]. Concerning knowledge acquisition, 6 measurement questions were formed by referring to the scales proposed by Tasng [16] and Dou [17]. Concerning environmental dynamics, measurement questions were formed by referring to Jansen's [18] research scale. In terms of service innovation performance, this paper modified the relevant measurement indicators developed by Storey, Fitzgerald, Avlonitis [19] et al. and formed 6 questions to analyze data and measure results. At the same time, enterprise size, enterprise age, and ownership category were used as control variables to study the relationship among different variables in the model.

4 Research Results

4.1 Reliability and validity tests of data

Reliability analysis is to evaluate the stability and dependability of a scale. Cronbach's α is used to test the

reliability of the variables through SPSS18.0 software, based on the data involved in this study. Network management has a Cronbach's α of 0.832, knowledge acquisition of 0.817, environmental dynamics of 0.844, and service innovation performance of 0.810. The overall Cronbach's α of the scale is 0.927, and that of each variable is above 0.8, indicating that the scale has good reliability.

Validity represents the degree to which a measurement tool or means can accurately measure. In this paper, KMO and Bartlett's test of sphericity are conducted through SPSS 18.0 for network management, knowledge acquisition, environmental dynamics, and service innovation performance. The results are shown in the table. The KMO values for all four variables are greater than the acceptable value of 0.7, which indicates relatively good validity. The Sig value of Bartlett's test of sphericity is 0.000, less than the significance level of 0.05. In addition, the factor loading of each question is greater than the critical value of 0.5, and the percentage of explained variance derived from each factor is greater than 0.5, which suggests good convergent validity and suitability for factor analysis.

The average values and correlation coefficients of major variables are shown in Table 1. Except that knowledge acquisition is correlated with service innovation performance at the level of 0.001, all other variables are significantly correlated at the level of 0.01. Furthermore, the correlation coefficient of each variable is less than 0.7, indicating that the common variance among the variables is not very high.

Table 1 Summary of descriptive statistical results of major variables

Variables	Average Values	Variances	Correlation Coefficients			
			NM	KA	ED	SIP
NM	3.62	.646	1			
KA	3.57	.567	0.454**	1		
ED	3.55	.671	0.517**	0.467**	1	
SIP	3.86	.845	0.387**	0.651***	0.443**	1

Note: *** indicates $P < 0.001$, ** indicates $P < 0.05$, and * indicates $P < 0$. NM = Network Management; KA = Knowledge Acquisition; ED = Environmental Dynamics; SIP = Service Innovation Performance

4.2 Hypothesis testing analysis

4.2.1 Test of the mediating role of knowledge acquisition

To verify the relationship among network management, knowledge acquisition, and service innovation performance, this paper applies structural equation modeling to test the mediating role of knowledge acquisition on network management and service innovation performance, according to the relevant research carried out by Wen et al. The test is

divided into 3 steps: First, the path coefficient of service innovation performance (dependent variable) and network management (independent variable) is tested, and the standardized path coefficient of regression is 0.301 ($P < 0.01$), which verifies Hypothesis 1; Second, partial mediation is tested by measuring the path coefficient of knowledge acquisition (mediator) and network management (independent variable) and that of service innovation performance (dependent variable) and knowledge acquisition (mediator), and the path coefficients are 0.483 ($P < 0.001$) and 0.597 ($P < 0.01$), which verifies Hypotheses 2 and 3; Third, full mediation is tested on knowledge acquisition (mediator), and the

standardized path coefficient of network management on service innovation performance is 0.144 ($P < 0.01$), which verifies Hypotheses 2 and 3; Third, full mediation is tested on knowledge acquisition (mediator), and the standardized path coefficient of network management on service innovation performance is 0.144 ($P < 0.01$), which indicates the partially mediating role of knowledge acquisition and verifies Hypothesis 4. The structural equation diagram is shown in Figure 2. CMIN/df = 2.307, less than the acceptance criterion of 2.5. CFI = 0.906, IFI = 0.907, and NFI = 0.920, all greater than the acceptance criterion of 0.90. The RMSEA value is 0.071, less than the acceptance

criterion of 0.08. The AIC value is 343.348, which is relatively small and meets the evaluation standard of this index. Based on the judgments of all indicators, the model fits well as a whole.

The indirect effect of network management on service innovation performance can be calculated as $0.471 \times 0.548 = 0.2581$. The results show that the total effect of network management on service innovation performance is 0.402, the direct effect is 0.144, and the indirect effect is 0.2581. Knowledge acquisition partially mediates network management and service innovation performance, with the indirect effect greater than the direct effect.

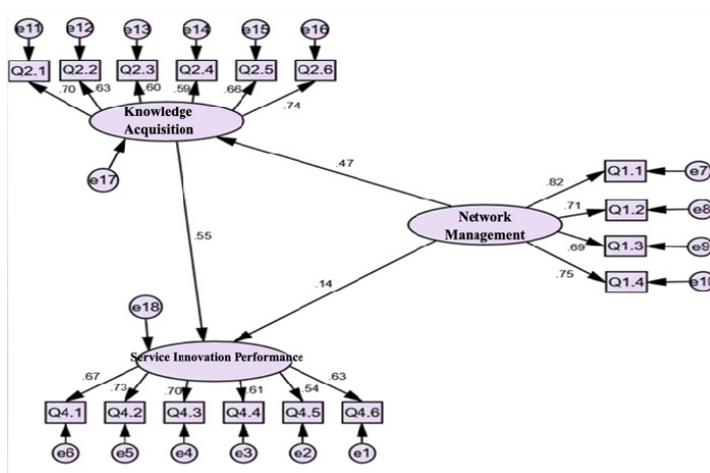


Fig. 2 Structural equation model and path analysis

4.2.2 Test of the moderating role of environmental dynamics

In this study, hierarchical regression analysis is applied to verify the moderating role of environmental dynamics. Model 1 presents the comprehensive scores under control variables. On the basis of Model 1, regression analysis is conducted to test the hypotheses proposed in this study. The regression results are shown in Table 2. Model 2 is constructed by adding network

management (independent variable) to Model 1. Model 3 introduces environmental dynamics (moderator), and Model 4 tests the moderating role of environmental dynamics on knowledge acquisition. According to the table, the interaction term of network management and environmental dynamics has a positive effect on knowledge acquisition with a coefficient of 0.317, which indicates a significant influence at the level of 0.01 and verifies Hypothesis

Table 2 Results of hierarchical regression analysis

Predictors		KA			
		Model 1	Model 2	Model 3	Model 4
Control Variables	Enterprise Size	-0.042	-0.064	-0.068	-0.072
	Ownership Category	0.073*	0.069	0.057	0.053
	Enterprise Age	0.104*	0.076*	0.060	0.044
Independent Variable	NM		0.392*		
Moderator	ED			0.201**	0.242**
Interaction Term	NM× ED				0.317**
Adjusted R ²		0.035	0.249	0.460	0.781
F		3.415	11.518	21.166	28.017

Note: *** indicates $P < 0.001$, ** indicates $P < 0.05$, and * indicates $P < 0.1$.

To show the relationship among the variables more

concisely and visually, we present an interactive graph

of the moderating role of environmental dynamics on network management and knowledge acquisition, which facilitates the analysis of environmental dynamics as a moderator. As shown in Figure 3, whether the external environment is volatile or not, the mediating role of

network management capability on knowledge acquisition cannot be underestimated. The more volatile the environment, the more network management capability can mediate knowledge acquisition.

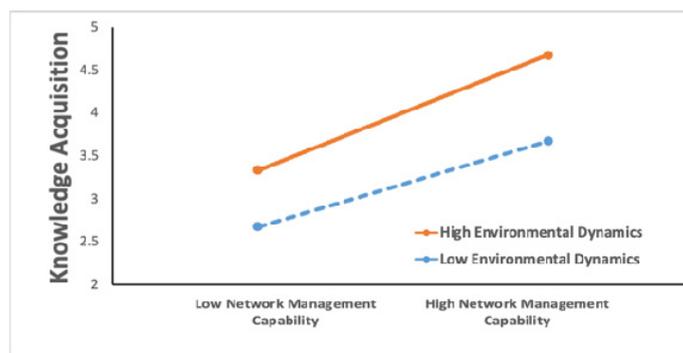


Fig. 3 Moderating role of environmental dynamics on network management and knowledge acquisition

5 Conclusion

5.1 Research contributions

First, by constructing a model and applying structural equation modeling, this study figures out the relationship among network management, knowledge acquisition, and service innovation performance. That is, knowledge acquisition plays a mediating role in network management and service innovation performance.

Second, through empirical analysis, this study verifies that knowledge acquisition has a significant positive effect on service innovation performance, a finding that coincides with previous research. Moreover, knowledge acquisition has a stronger influence on service innovation performance than network management capability, which indicates that the mastery of innovative and novel knowledge in the environment can better promote service innovation in service enterprises. This provides a compelling reason for enterprises to acquire scarce, inimitable knowledge.

Finally, the results demonstrate the moderating role of environmental dynamics in the model. Environmental dynamics effectively moderate the influence of network management capability on knowledge acquisition.

5.2 Management insights

First, enterprises should break the innovation barriers, build a network-based innovation model, form an open ecosystem, and encourage more network subjects to participate in the service innovation process to collaborate in innovation and resist the impact of an uncertain environment. At the same time, enterprises should maintain smooth communication with network subjects, optimize and update network relationships, and reduce the frequency and intensity of network conflicts, so as to provide a harmonious, comfortable network

environment for collaborative innovation among network subjects.

Second, enterprises should obtain external information and technologies of different structures and levels from external networks, so as to provide information and directions for enterprises to carry out multi-faceted and multi-directional service innovation activities. Besides, the knowledge obtained from multiple information channels facilitates enterprises to screen, combine, integrate, and extract more accurate innovation information, enabling them to seize opportunities in the midst of changes and enjoy more possibilities for coping with an uncertain environment.

Finally, in a dynamic environment, enterprises should capture advantageous resources (e.g., novel ideas and potential customer needs) at the overall network level through their superior network locations. This provides a reliable basis for leaders to quickly and accurately develop corresponding strategic policies to take the lead in putting unique and creative ideas into practice.

5.3 Research limitations and future prospects

Our study still exist the following shortcomings. First, the respondents of this study are mainly selected from the service enterprises in Xi'an High-tech Zone, which suggests the limitation in region selection. Second, this study shows that network management can generate superior network locations, but it does not point out which network locations are more conducive to gaining useful knowledge and enhancing service innovation performance. Third, in a dynamic environment, knowledge acquisition is not the only mediator amid the influence of network management on service innovation performance.

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