The Impact of Enterprise Digital Transformation on Customer Service Innovation Performance

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Abstract. In the context of the digital economy, the emerging digital technologies have made the digital transformation of enterprises an unavoidable trend to help improving customer service. This paper conducted a sample survey of 139 Chinese companies and used multiple regression equation analysis to try to explore the mechanism between enterprise digital transformation and customer service innovation performance. The research results showed that: (1) Enterprise digital transformation had a significant direct positive impact on customer service innovation performance; (2) Enterprise cross-border activities played a partial mediating role in the process of enterprise digital transformation affecting customer service innovation performance; (3) Both proactive market orientation and reactive market orientation positively moderated the positive relationship between enterprise digital transformation and enterprise cross-border activities. That is, the higher the enterprise's proactive market orientation and reactive market orientation, the stronger the impact of enterprise digital transformation on enterprise cross-border activities. The above research results have important theoretical and practical significance for understanding the complex relationship between enterprise digital transformation and customer service innovation, and for improving the enterprise's ability to serve customers.

Keywords: Enterprise Digital Transformation · Cross-border Activities · Market Orientation · Customer Service Innovation Performance

1 Introduction

The new round of technological revolution and industrial transformation is promoting the rapid development of digital industrial technologies such as artificial intelligence, cloud computing, and big data, which in turn promotes the continuous and deep integration of digital technology and the real economy, and accelerates the digital transformation of enterprises. Entering the era of digital knowledge economy, customer service innovation has become an important driving force for companies to quickly respond to customer needs and improve corporate service quality. However, in the past, enterprises' emphasis on innovation was often limited to the technical level, and insufficient attention was paid

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to service innovation in the service department (Zhang et al., 2010) [1]. In fact, enterprise service innovation is the process of breaking through previous technical limitations and utilizing the services provided by new technologies (Qi and Wang, 2022) [2]. Service innovation not only involves the improvement of service technology, but also includes the integration of optimizing customer service, service delivery systems and technology selection (Johne and Storey, 1998) [3]. For enterprises, customer service innovation is a key factor in improving their core competitiveness. Therefore, it is of great significance to study the impact of enterprises digital transformation on customer service innovation performance.

Based on the development of new technologies, enterprises can cross their own organizational boundaries and seek external resources and knowledge to make up for their own insufficient endowments and shortcomings in their capability structures. This cross-border search for knowledge is called cross-border activities (Wu et al., 2015) [4]. Existing research on cross-border activities pays more attention to the impact of cross-border activities driven by new technologies on cooperation between enterprises and other organizations and the efficiency of resource acquisition. This study includes the cross-border activities of enterprises as mediating variables to explore their role on enterprise digital transformation affecting customer service innovation performance.

In addition, the choice of different market orientations by enterprises will affect cross-border knowledge search, thereby affecting corporate innovation (Qu, 2021) [5]. This study incorporates market orientation as a boundary condition into the model to explore the impact of different market orientations on enterprise digital transformation affecting cross-border activities.

Based on this, this study attempts to conduct an empirical study to find out whether and how enterprise digital transformation affects customer service innovation performance, by focusing on the meditating role of enterprise cross-border activities and moderating role of market orientation under the background of digitalization, so as to help companies strengthen their service capabilities and service efficiency.

2 Literatures Review and Research Hypotheses

Enterprise digital transformation is the process of using a variety of digital technologies to promote the reconstruction and optimization of all levels of the enterprise, enabling enterprises to reduce production costs, improve production and service efficiency, control business risks, and thereby enhance their core competitiveness (Pei et al., 2023) [6]. Based on the research on enterprise digital transformation by many scholars, the impact of enterprise digital transformation behavior on enterprises is multi-level, diversified, and throughout the entire process, while the impact on customer service is rarely touched upon.

In the context of digitalization, a large number of studies have proven that the rapid development of technology has a significant positive effect on enterprise service innovation performance (Jian et al., 2014) [7], at the same time, the enterprise's own ability to absorb new technologies will also affect the enterprise's service innovation performance (Xiao, 2013) [8]. It can be seen from a large number of studies that there is a strong correlation between an enterprise's customer service innovation performance and its use of new technologies. Based on this, this study puts forward the following hypothesis:

H1: Enterprise digital transformation has a significant positive impact on customer service innovation performance.

Rosenkopf and Nerkar (2001) [9] proposed the concept of cross-border search, which refers to the activities that enterprises will carry out to search for external knowledge across organizational boundaries and knowledge bases in a dynamic environment. Cross-border activities enable enterprises to contact the outside and obtain innovation knowledge. Enterprise cross-border activities are an important way to help enterprises innovate, and they will also affect the innovation performance of enterprises (Wang and Wei, 2017) [10], that is, the enterprise's cross-border activities have a good positive impact on corporate innovation. To sum up, the cross-border activities of enterprises have a direct and positive relationship with customer service innovation performance. Accordingly, this study proposes the following hypotheses:

H2: Enterprise cross-border activities have a significant positive impact on customer service innovation performance.

The digital transformation of enterprises can help enterprises cross the "digital divide" and promote customer service innovation (Zhu, 2023) [11]. Cross-border activities can help companies break through their own boundaries to obtain external technology and information (Wu et al., 2015; Fu, 2023) [4][12]. The technical resources acquired by enterprises through cross-border activities will help enterprises apply it to customer service innovation in the process of digital transformation. Based on this, combined with the previous hypothesis analysis, this study proposes the following hypotheses:

H3: Enterprise cross-border activities mediate the relationship between enterprise digital transformation and customer service innovation performance.

Market orientation is a series of behaviors or activities that collect, disseminate and respond to market intelligence (Wu et al., 2021) [13]. Narver et al. (2004) [14] and others divided market orientation into proactive market orientation and reactive market orientation based on customers' explicit and implicit needs. Proactive market orientation is to proactively focus on the potential needs of customers, not limited to the needs and knowledge currently expressed by customers, and always maintain sensitivity to new markets, new technologies and new ideas (Xu, 2019) [15]. The reactive market orientation focuses on the explicit needs of customers and also pays attention to the information of the existing market. The proactive market orientation and the reactive market orientation use exploratory knowledge resources and exploitative knowledge resources respectively to guide enterprises to carry out exploratory knowledge resources and exploitative activities (Jian et al., 2018) [7]. The higher level of market orientation, the more it can promote cross-border activities under the impact of enterprise digital transformation. Accordingly, this study proposes the following hypotheses:

H4a: Proactive market orientation mediates the relationship between enterprise digital transformation and cross-border activities. That is, the higher level of proactive market orientation, the stronger positive impact of enterprise digital transformation on cross-border activities.

H4b: Reactive market orientation mediates the relationship between enterprise digital transformation and cross-border activities. That is, the higher level of reactive market orientation, the stronger positive impact of enterprise digital transformation on cross-border activities.

3 Research Design

3.1 Research Framework

According to the previous literature review, this paper's research framework and hypotheses are presented as Fig. 1.

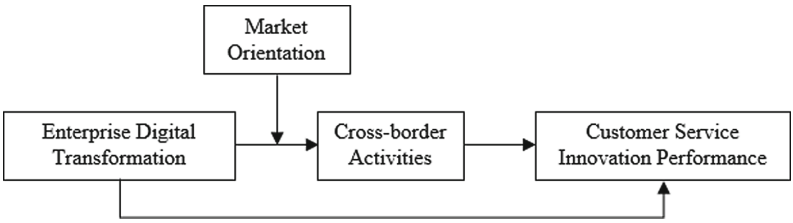

Fig.1. The research framework

3.2 Measurement

In measuring variables, this study mainly used tested high-cited measurement scales to ensure the validity and reliability of the research tools. All measurement scales are Likert-5 rating scales.

Among them, the enterprise digital transformation scale comes from the research of (Chi, 2020) [16] to design the questionnaire, with a total of 3 items. The cross-border activity scale mainly refers to the research of (Wang et al., 2023) [17] to design the questionnaire, including two dimensions: cross-border search for technical knowledge (5 items) and cross-border search for market knowledge (4 items), with a total of 9 items Question composition. The proactive market orientation scale mainly refers to the research of (Zhu et al., 2016) [18] to design the questionnaire, with a total of 5 items. The reactive market orientation scale mainly refers to the research of (Zhu et al., 2016) [18] to design the questionnaire, with a total of 5 items. The customer innovation service performance scale mainly refers to the research of (Avlonitis et al., 2001) [19] to design the questionnaire, which includes two dimensions: customer service financial performance (6 items) and customer service non-financial performance (5 items), with a total of 11 items.

3.3 Sampling

The data for this study were collected from the middle and senior leaders responsible for enterprise digital management in 139 enterprises in a provincial association in China. A total of 150 questionnaires were distributed and lasted for one week. A total of 150 questionnaires were recovered, of which 142 were completed with complete answers. After excluding 3 questionnaires with complete logical questions, a total of 139 valid questionnaires were obtained, with an effective recovery rate of 94.7%. Among the 139 manager samples, the majority are male managers, with 114 people accounting for 82%;

In terms of age, they are mainly young and middle-aged managers, with an average age of 34.9 years (standard deviation = 5.8 years); In terms of educational background, employees with high education account for a large proportion. There are 45 people with master's and doctoral degrees, accounting for 32.4%, 79 people with bachelor's degrees, accounting for 56.8%, and 15 people with junior college or below, accounting for 10.8%; At the management level, there are 122 senior managers, accounting for 87.8%, 16 middle managers, accounting for 11.5%, and 1 junior manager, accounting for 0.7%.

4 Data Analysis

4.1 Reliability and Validity Analysis

We used SPSS19.0 to do alpha test for ensuring the reliability of measuring scales, and the tested results indicated that all Cronbach's α value were greater than the standard value of 0.7 which presented in Table 1, showing that the measuring scales of Enterprise Digital Transformation, Cross-border Activities, Market Orientation, and Customer Service Innovation Performance have good reliability.

Table 1. Cronbach's α value of measuring scales.

Variables	α value
Enterprise digital transformation	0.75
Cross-border activities	0.77
Proactive market orientation	0.84
Reactive market orientation	0.83
Customer service innovation performance	0.85

And the validity test of Enterprise digital transformation, Cross-border activities, Market Orientation, and Customer Service Innovation Performance was used CFA method. The results presented in Table 2 indicated that all AVE (average variance extracted) and CR (composite reliability) values are higher than the standard of 0.45 and 0.7, suggesting that all measuring scales of Enterprise digital transformation, Cross-border activities, Market Orientation, and Customer Service Innovation Performance have good validity.

Table 2. AVE and CR values of measuring scales.

Variables	AVE value	CR value
Enterprise digital transformation	0.45	0.75
Cross-border activities	0.46	0.89
Proactive market orientation	0.51	0.84
Reactive market orientation Customer service innovation performance	0.49 0.49	0.82 0.91

4.2 Descriptive Statistical Analysis

Table 3 performs descriptive statistical analysis on the variables and control variables of this study, and summarizes the mean, variance and correlation coefficient of the study variables of Enterprise digital transformation (EDT), Cross-border activities (CBA), Proactive Market Orientation (PMO), Reactive Market Orientation (RMO) and Customer Service Innovation Performance (CSIP) and control variables of Gender (GEN), Age, Education (EDU), Position Level (PL). Correlation analysis results show that enterprise digital transformation has a significant positive correlation with cross-border activities ($r = 0.76$, $p < 0.01$), proactive market orientation ($r = 0.22$, $p < 0.01$), reactive market orientation ($r = 0.20$, $p < 0.05$) and customer service innovation performance ($r = 0.76$, $p < 0.01$). Cross-border activities have a significant positive correlation with customer service innovation performance ($r = 0.86$, $p < 0.01$). Positive correlation results provide good guarantee for the verification of the research hypothesis of this study.

Table 3. Means, standard deviations, and correlations

Variables	1	2	3	4	5	6	7	8	9
1. GEN	1.00								
2. AGE	−0.02	1.00							
3. EDU	−0.13	−0.04	1.00						
4. PL	0.07	−0.25**	0.02	1.00					
5. EDT	−0.07	−0.59**	0.08	0.37**	1.00				
6. CBA	−0.05	−0.45**	0.08	0.25**	0.76**	1.00			
7. PMO	0.00	−0.15	−0.03	−0.02	0.22**	0.33**	1.00		
8. RMO	0.00	−0.16	−0.13	−0.05	0.20*	0.31**	0.83**	1.00	
9. CSIP	−0.05	−0.48**	0.03	0.24**	0.76**	0.86**	0.23**	0.27**	1.00
Mean	0.18	34.92	2.21	2.87	3.34	3.36	3.37	3.37	3.30
SD	0.39	5.78	0.62	0.36	0.88	0.78	0.84	0.79	0.77

Notes: $N = 139$. ** $p < 0.01$, * $p < 0.05$

4.3 Hypotheses Test

Hierarchical multiple regression analysis with SPSS 19.0 was used to test hypotheses by entering in control variables (i.e., age, gender, education and position level), independent variable (i.e., Enterprise digital transformation), mediator variable (i.e., Cross−border activities), and moderator variable (i.e., Proactive market orientation, Reactive market orientation) on separate steps. Table 4 presents the results.

Table 4. Hierarchical regression hypothesis test results

	CSIP			CBA				
	Model1	Model2	Model3	Model4	Model5	Model6	Model7	Model8
Control variables								
GEN	−0.07	0.00	−0.02	−0.01	−0.21	−0.30	−0.18	0.02
AGE	−0.45**	−0.06	−0.12*	−0.05	−0.03	0.01	0.00	−0.01
EDU	0.00	−0.03	−0.04	−0.04	0.18	0.19	0.14	0.03
PL	0.14*	−0.05	0.01	−0.03	−0.03	−0.01	−0.02	−0.03
Independent variable								
EDT		0.75**		0.24**	0.21 *	0.76**	0.73**	0.73**
Mediator								
CBA			0.80**	0.66**				
Moderator								
PMO							0.17**	
RMO								0.20**
Interaction								
EDT × PMO							0.21**	
EDT × RMO								0.15**
R^2	0.26	0.58	0.75	0.77	0.23	0.57	0.63	0.62
$\triangle R^2$	0.26	0.33	0.49	0.19	0.23	0.34	0.05	0.05
F	11.48**	37.23**	81.21**	74.61**	10.07*	35.53**	31.26**	30.81**
△F	11.48**	104.72**	268.48**	109.56**	10.07*	105.90**	9.38**	8.71**

Notes: $N = 139$. ** $p < 0.01$, * $p < 0.05$

According to the results of model M2 in Table 4, it is found that enterprise digital transformation has a significant positive impact on customer service innovation performance (M2, $\beta = 0.75$, $p < 0.01$), and H1 is established.

According to the results of model M3, it can be found that cross-border activities also have a significant positive impact on customer service innovation performance (M3, $\beta = 0.80$, $p < 0.01$), and H2 is established.

It can be known from model M4 that when the mediating variable cross-border activities is added to the regression equation of model M4, the impact coefficient of enterprise digital transformation on customer service innovation performance (M2, $\beta = 0.75$, $p < 0.01$) is significantly weakened by 72% (M4, $\beta = 0.24$, $p < 0.01$). In addition, the results of model M6 also show that enterprise digital transformation has a significant positive impact on enterprise cross-border activities (M6, $\beta = 0.76$, $p < 0.01$). Therefore, based on the above empirical results, this paper can draw the following conclusion that cross-border activities play a partial mediating role between enterprise digital transformation and knowledge-based customer service innovation performance. Thus, H3 is supported by the data.

This study draws on Hayes (2013) [20], Zhou and Zhou (2021) [21] and others recommended the Bootstrapping method to further test the significance of the mediating effect of cross-border activities. The results show that the mediating effect of cross-border activities on enterprise digital transformation and customer service innovation performance is 0.440, and its 95% confidence interval is [0.275, 0.658]. The confidence interval of the mediating effect of cross-border activities does not include zero. Therefore, the mediating effect of cross-border activities is significant, and H3 is further supported by the data, that is, the significance of part of the mediating effect of cross-border activities has been verified.

4.4 Analysis of the Regulatory Effect of Market Orientation

By comparing models M6 and M7, it can be found that after the interaction variable "enterprise digital transformation × proactive market orientation" is introduced in model M7, the variance explanatory power (R^2) of model M7 not only significantly increases by 10.5%, but also the interaction variable also has a significant impact on Cross-border activities ($M7, \beta = 0.21, p < 0.01$), indicating that proactive market orientation moderates the relationship between enterprise digital transformation and cross-border activities significantly. That is, the higher the proactive market orientation, the stronger the positive impact of enterprise digital transformation on corporate cross-border activities. H4a is supported. Figure 2 shows the influence pattern of this interaction.

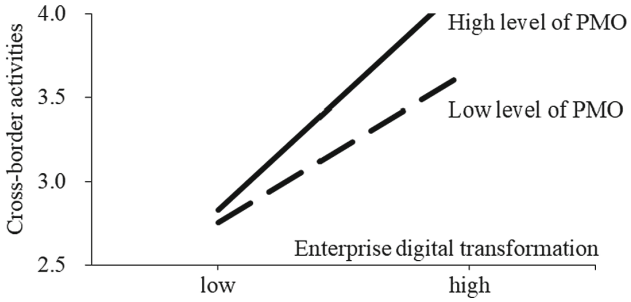

Fig.2. Differences of proactive market orientation on enterprise digital transformation impacting enterprise cross-border activities

By comparing models M6 and M8, it can be found that after the interaction variable "enterprise digital transformation × reactive market orientation" is introduced in model M8, the variance explanatory power (R^2) of model M8 not only significantly increases by 8.8%, but also the interaction variable has a significant positive impact (M8, $\beta = 0.15$, $p < 0.01$), indicating that reactive market orientation has a significant positive moderating effect in the process of enterprise digital transformation positively affecting enterprise cross-border activities. That is, the higher the reactive market orientation, the stronger the positive impact of enterprise digital transformation on enterprise cross-border activities. H4b is supported. Figure 3 shows the influence pattern of this interaction.

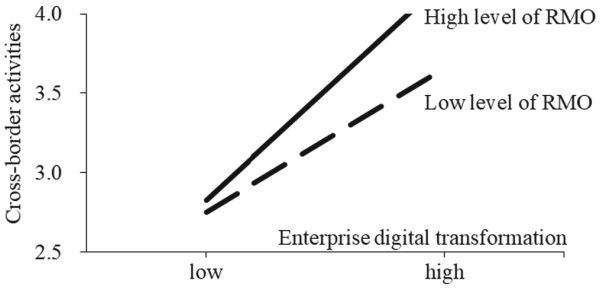

Fig.3. Differences of reactive market orientation on enterprise digital transformation impacting enterprise cross-border activities

5 Conclusions and Discussion

This study conducted a sample survey of 139 Chinese companies and used multiple regression equation analysis to try to explore the mechanism between enterprise digital transformation and customer service innovation performance. The results have theoretical and practical significance.

Firstly, this study confirmed that enterprise digital transformation was a powerful positive variable affecting customer service innovation performance in the context of digitization. Enterprise digital transformation can significantly improve customer service innovation performance, and customer service innovation can optimize the enterprise's customer service capabilities, accurately identify customer and market demands, and have a positive impact on the enterprise's development. Therefore, in the context of digitization, enterprises should pay attention to customer service innovation, actively utilize new technologies such as artificial intelligence and big data to optimize customer service systems, and fully utilize the knowledge and information obtained during the digital transformation process to expand the positive impact on customer service innovation performance.

Secondly, this study also found that enterprise's cross-border activities mediated the positive relationship between enterprise digital transformation and customer service innovation performance. Clarifying how enterprise digital transformation contributes to customer service innovation is of significant importance for people to gain a deeper

understanding of how enterprise digital transformation enhances customer service innovation performance. It is evident that in the process from enterprise digital transformation to cross-border activities to the impact on customer service innovation performance, if an enterprise wants to innovate in customer service during the digital transformation, it needs to use new digital technologies. This process of seeking knowledge requires enterprises to break through their organizational boundaries to obtain external resources and information, including innovatively reforming the enterprise's strategic goals, collaborating with technology companies in different industries, establishing new technology research and development departments, and hiring technical experts to enable the enterprise to more efficiently obtain and utilize external new knowledge and technology. This allows the enterprise to effectively explore market changes and consumer demands, innovate in serving customers, optimize customer service processes, and ultimately enhance customer service innovation performance.

Thirdly, the empirical results of this study indicated that different market orientations chosen by enterprises will affect the degree of participation in cross-border activities during enterprise digital transformation, thereby influencing the enterprise's customer service innovation performance. By introducing market orientation as an important extension of the impact of enterprise digital transformation on customer service innovation performance, this study explored the boundary of the moderated role of proactive market orientation and reactive market orientation on enterprise digital transformation affecting customer service innovation performance. Therefore, in the process of enterprise digital transformation, the selected market orientation should match the formulated enterprise strategy, and analyzing the enterprise's own market orientation will enable the enterprise to more efficiently and effectively search for and use external knowledge and technology, reducing exploration costs and improving the efficiency of knowledge search and transformation.

Finally, this paper explored the relationship between enterprise digital transformation and customer service innovation performance, as well as focusing on the mediating and moderating effects of cross-border activities and market orientation, and makes certain theoretical and managerial contributions. However, there are still some limitations: (1) This study is too broad in its conceptual research on enterprise digital transformation, and in the future, it can conduct more in-depth research on digital transformation to refine the independent variables; (2) This paper primarily focuses on studying the effects of cross-border activities and market orientation on customer innovation performance. Future research can delve further into additional mediating and moderating variables to better optimize the enterprise's digital transformation customer innovation service performance model.

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