

The Research on the Mechanism of Marketing Digitization Support on NPD Performance

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Abstract. Many managers expect that digitization have a significant impact on product innovation, however, companies invest in digitization without corresponding performance growth. Scholars call this phenomenon the "digital paradox". Drawing on the IT business value literature, this paper develops a comprehensive conceptual model to explore how three types of MDS can promote the performance of NPD. Based on survey data from managers and employees of businesses undergoing digital transformation in Zhejiang Province, the study provides some insights. The MDS promotes the performance of NDP, which is affected by ET and EIL. Specifically, ET negatively regulates the role of MDS on NPD performance; EIL elevates the role of MDS in NPD performance.

Keywords: digitization; Environmental turbulence; Employee information literacy

1 Introduction

Digital transformation has become a necessity for enterprises, but in reality, many companies have invested in digitization without corresponding performance growth. Scholars call this the "digital paradox" (Gebauer et al., 2020). When analyzing the causes of this phenomenon, most scholars agree that the unclear direction of digital transformation is the key to the low performance of enterprise transformation (Kohtamäki et al., 2020; Chi Maomao et al., 2020). New product development(NPD) performance is an important part of enterprise transformation performance, and scholars focuses on the perspective of product development and enterprise capabilities, and lacked attention to the marketing digital support (Schweitzer et al., 2019; Chi Mao et al., 2020; Wehrle et al.,2022).The provision of high-quality technical support to sales personnel and high-level service support to customers is one of the key factors for the successful development of new products (Benedetto, 1999). Recent empirical studies have shown that increased levels of service support mitigate the negative effects of digitization on business performance (Kohtamäki et al., 2020). Therefore, from the perspective of marketing, this study discusses the relationship and mechanism between marketing digitization support(MDS) and new product development performance.

Based on the research on IT business value and existing theoretical results, this paper explores the influence mechanism of MDS on the performance of NPD from two perspectives: environmental turbulence (ET) and employee information literacy (EIL). Firstly, after reviewing a large number of literature related to digitization and new product development performance, this paper finds that MDS can be divided into three types: digitalization of sales support (DS1), digitalization of service support (DS2), and data analysis support (DS3), all of which are related to NPD performance, and the relationship between them is affected by two factors: ET and EIL.

Secondly, based on the IT business value research model and related theories, this paper constructs a conceptual model and puts forward corresponding hypotheses. Then, this study collects questionnaire data from companies undergoing digital transformation, through factor analysis, correlation analysis, and multi-layer regression analysis, to test the research hypotheses. Finally, according to the research results, the contributions and shortcomings of this study are discussed.

The main conclusion of this study is that the DS1, DS2, DS3 provided by enterprises to the marketing process promote the performance of NPD, but this relationship is affected by ET and EIL. Specifically, ET negatively moderates the role of MDS on new product development performance. EIL elevates the role of MDS in new product development performance. This paper explores and verifies the two core issues of where and how to transform enterprises, and has enlightenment for exploring the path of enterprise product innovation in the context of digitization.

2 Theory and hypotheses

2.1 digitization and performance

The discussion of the relationship between digitization and new product development performance is a relatively new field. So far, it has only a total of 98 relevant literature, including 3 in China and 95 abroad, and most of the research focuses on IT, digital transformation, or digitization of a certain link. For example, though quantitatively measured 216 key stakeholders of manufacturing enterprises from the perspective of product digitization, Schweitzer believed that the digital transformation of product life cycle management promoted the improvement of new product development performance and verified the moderating role of organizational complexity (Schweitzer et al., 2019). From the perspective of digital transformation, digital transformation can have a positive effect on the performance of new product development by improving enterprises' R&D utilization capabilities and R&D exploration capabilities, based on the survey data of 207 small and medium-sized medical device manufacturing enterprises in Hubei Province (Chi Mao et al., 2020). When other scholars explored the relationship between digital level and product innovation performance, they showed that the level of digital construction and the product innovation performance showed an inverted U relationship (Kohtamäki et al., 2020). For example, the digital access level, digital application level, digital circulation level and product innovation performance showed a U-shaped relationship, and the dual ability of enterprises played a mediating role in it (Xiao Renqiao et al., 2020). Scholars from the perspective of supply chain digitization, through interviews with 91 experts in Delphi method, believed that digitization affected the procurement and supply functions in new product development in different time frames and forms, and supply chain digitization was expected to become a potential promoter (Wehrle et al., 2022).

Based on the above literature combing, we found that the relationship between digitization and new product development performance is not clear, and the views of scholars have not yet been agreed. At the same time, scholars have begun to explore the mediating effect and regulatory mechanism. In addition, different perspectives, measurement methods, and research objects are the main reasons for disagreement.

On the other way, scholars have also conducted research on digitization and other performance (e.g., innovation performance, financial performance, organizational performance, etc.), and the results have not reached a consensus. IT infrastructure flexibility improves the core capabilities of enterprises, thereby improving enterprise performance (Byrd, 2001). IT capabilities by influencing organizational learning and thus financial performance through questionnaires (Tippins, 2003). Through econometric research, the digital transformation of enterprises has a significant effect on enterprise performance (He Fan, 2019). Digital transformation has a positive role in promoting enterprise performance through a questionnaire survey of Zhejiang high-tech enterprises, and organizational learning plays an important role in regulating it (Hu Qing, 2020).

Yu Feifei and other scholars (2022) started from the four indicators of value chain digitization, business process digitization, product and service digitization and the application of digital technology to construct enterprise digitization measurement standards, and verified the inverted U-shaped relationship between enterprise digitization and innovation performance based on the theory of technological leap and empirical research on Internet enterprises, indicating that enterprises' early investment in digitization can indeed play a role in innovation performance, but with the increase of digital investment, innovation performance has declined. digitization and financial performance are U-shaped, and the level of service can alleviate the negative effects of digital transformation on the financial performance of the organization in the early stage (Kohtamäki et al., 2020).

Marketing digitization is based on digital technology as the core driving force and means, and emphasizes the changes based on digital technology at the marketing level, promoting the all-round transformation of the core business of enterprises, including brand, market, sales, channels and transactions, consumers and services, and carrying out online, automated and intelligent innovation of traditional marketing methods, and ultimately driving business growth (Wu Chao et al., 2022). Front-end digitization of the value chain of manufacturing firms refers to the use of digital technologies by companies to collect, store, analyze and use market data to increase value, co-create and reduce costs (Kohtamäki et al., 2020).

This study defines MDS as the technical support provided by enterprises to the marketing end using digital technology or digital systems, and divides it into three types: digital sales support, digital service support and data analysis support.

2.2 IT business value theories

IT Business value theory began with a pure discussion of the relationship between the application of information technology and firm performance, and later scholars gradually began to look for situational variables and found that changes in the external environment, organizational culture, and human capital are the three key potential variables. Enterprise investment in IT can promote the full development of enterprise capabilities, new product development, and product quality and value improvement, which in turn has a significant impact on organizational performance (Barua, 1995). The scholar pointed out that the impact of enterprise investment in IT on new product development is significant and conducive to the improvement of organizational performance, and at the same time, the external environment is a moderator that cannot be ignored in this process, which was mentioned in the discussion session, and subsequent scholars should be committed to this. From the perspective of

infrastructure, IT infrastructure flexibility improves the core capabilities of enterprises, thereby improving enterprise performance (Byrd, 2001). Then when IT as a technical resource is introduced into the business process of the enterprise, it will not only be affected by the external environment, but also constrained by the internal resources of the enterprise (such as organization and structure, culture and system, human capital, etc.)(Melville, 2004). This emphasizes that IT investment needs to be combined with internal and external resources of the enterprise in order to act on business processes and improve organizational performance. Enterprise' IT capabilities and high-level attention to IT can effectively promote the use of technology in the process of new product development, thereby generating IT competence and improving new product development performance (Mauerhoefer et al., 2017).

IT The generation of business value is both influenced by the external environment and limited by internal conditions (Melville, 2004). Therefore, this study draws on the IT business value theory to explore the mechanism of marketing digital support, and reveals the specific impact mechanism of marketing digital support on the performance of new product development. In addition, some of scholar's view emphasizes the important role of external situational factors in the new product development stage(Barua, 1995), while some proposed that IT business value generation is related to internal situational factors such as organization and structure, culture and system, human capital, (Melville, 2004) , and also some believe that strategy, culture and organizational structure are key moderating variables (Mauerhoefer et al. , 2017). In summary, these models provide a theoretical basis for exploring the relationship between marketing digital support and new product development performance in this study, and introducing three contextual factors of technological turmoil, digital organizational culture, and employee information literacy as moderating variables.

So, the impact of IT introduction on new product development performance will be affected by both the external environment and internal conditions, especially the turbulence of external technology, internal digital organizational culture and employee information literacy.

2.3 Research model and hypotheses

DS1 is designed to help salespeople acquire and retain customers and reduce administrative time for effective account management (Speier and Venkatesh,2002). DS2 aims to coordinate service requests and delivery in a system by enabling customers to serve themselves by providing a knowledge base of solutions that allows customers to enter and access digital systems directly at any time (Meuter et al., 2000). DS3 refers to the development or purchase of a central database that stores all customer-related information (Jayachandran et al., 2005), and relevant functions, such as sales, customer service, and product development, can access the database according to account login to obtain valid data information. By integrating and analyzing data through software, stakeholders can understand customer preferences and estimate customer lifetime value, retention, and loyalty (Greenberg, 2001). Therefore, the establishment of such databases and systems is part of the key infrastructure of enterprise digitization (JiFeng et al., 2021), and the MDS provided by them is a key component of enterprises trying to create customer assets through long-term relationships (Berger et al., 2002). In short, enterprises using emerging digital technologies can support enterprises to obtain customer data, analyze customer demand characteristics and behavioral preferences, accumulate and share customer knowledge, and then achieve the goal of providing customers with products and services in a targeted manner (Jayachandran et al., 2005).

Therefore, Figure 1 proposes hypotheses:

H1 MDS has a positive impact on NDP performance

H1a:DS1 has a positive impact on NPD performance

H1b:DS2 has a positive impact on NPD performance

H1c:DS3 has a positive impact on NPD performance

The continuous advancement of technology stimulates customer demand for novelty and convenience, and stimulates the expectation of higher performance and additional functions of products and services (Danneels, 2004), which brings new challenges to the development of new products for enterprises. The information obtained from customers and competitors obtained from the marketing side may soon become obsolete data and no longer be used, which not only increases the cost of data warehousing, but also brings a lot of search costs to product developers and reduces the efficiency of new product development (Shao & Lin, 2016). Companies provide digital service support to customers with the aim of coordinating requests and deliveries of customer service (Meuter et al., 2000), reducing labor costs and maintaining customer relationships. The support of services by digital technologies makes customers less tolerant of poor service quality or slow response, forcing companies to abandon previously reliable products and processes to meet changing customer needs (Ansari et al., 2015). Calantone et al. (2003) found that environmental turmoil significantly affects enterprises' new product development strategy decisions, and the digital support provided by enterprises for data analysis may be inaccurate when environmental volatility is high (Pasha and Poister, 2017), resulting in the wrong direction of new product development, and ultimately leading to lower performance.

Based on the above analysis, this study proposes hypotheses:

H2:ET plays a negative moderating role between MDS and NPD performance

H2a:ET plays a negative moderating role between DS1 and NPD performance

H2b:ET plays a negative moderating role between DS2 and NPD performance

H2c:ET plays a negative moderating role between DS3 and NPD performance

With the advent of the digital economy and the digital transformation of the whole industry, the effect of employees' knowledge level, information literacy and other factors on the overall innovation behavior of enterprises is becoming more and more obvious (Wang Zongjun et al., 2020). Therefore, this study incorporates employee information literacy into a theoretical model.

EIL is the ability and attitude of individuals to search, acquire, evaluate, use and create various information in the work scene, and is the application of information literacy in solving tasks in the workplace. Existing studies have shown that EIL plays a key role in the transformation of technology application into innovation performance (Jacalyn, 2014). In addition, EIL can improve the applicability of technology introduction and enhance employee creativity (Ahmad et al., 2013). The increased frequency of technology use and the reduction of relationship conflicts are conducive to improving the performance of new product development (Yan & Wagner, 2017).

Based on the above analysis, this study proposes hypotheses:

H3: EIL plays a positive moderating role between MDS and NPD performance

H3a: EIL plays a positive moderating role between DS1 and NPD performance

H3b: EIL plays a positive moderating role between DS2 and NPD performance

H3c: EIL plays a positive moderating role between DS3 and NPD performance

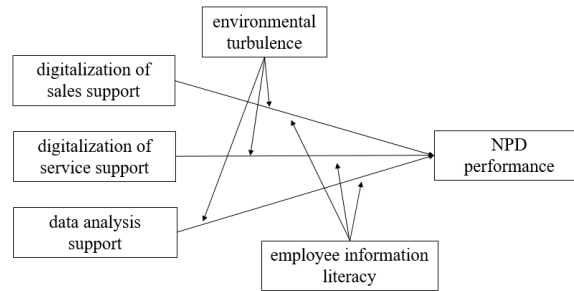


Fig. 1 the research model

3 Methods

3.1 Sample and data collection

This study targeted senior managers, marketing or product managers, or employees of relevant departments in enterprises undergoing digital transformation in Zhejiang Province. In the end, 400 copies were distributed, 347 were recovered, and 290 were finally obtained after removing invalid samples.

Table 1. The basic situation of the respondent and its enterprise was described and analyzed from four aspects: enterprise age, enterprise scale, industry characteristics and the position of the participant.

Table 1 Sample Composition (n=290)

Firm size	Percent	Firm age	Percent
0-50	22.1%	0-3	22.4%
50-100	21.7%	3-5	33.1%
100-300	21%	6-10	18.6%
300-800	15.9%	>10	25.9%
>800	19.3%	Industry	Percent
Duty	Percent	Primary industry	27.2%
manager	59.3%	Secondary industry	36.9%
Staff	40.7%	Tertiary industry	35.9%

3.2 Survey questionnaire and variables

Using questionnaire survey, explore the mechanism of marketing digital support and new product development performance. There are 7 variables in total. The measurement of digital support for enterprise marketing is based on the refined version of the scale of digital technology

for customer relationship management (Jayachandran et al., 2005), while marketing digital support is based on digital technology to manage customer relationships, increase the frequency and degree of interaction and communication, and thus create higher value for customers. Therefore, this study uses three sub-dimensions of digital sales support ($\alpha=0.877$), digital service support ($\alpha=0.836$), and data analysis support($\alpha=0.892$) to measure MDS (Jayachandran et al., 2005; Kohtamäki et al., 2020).

ET is measured by the three topics of "the degree of technological change related to products, the degree of opportunities brought by technological change, and the speed from product design to market"(Calantone et al., 2003; HaiBenlv et al., 2017) ($\alpha=0.852$). The measurement of EIL by using the four questions of "quickly identifying information quality, quickly obtaining the required information, analyzing the meaning of information, and using information to achieve innovation and improvement"(Chang and Hsu, 2015; Wang Zongjun, 2020) ($\alpha=0.828$). The measurement of NPD performance adopts five questions: "customer demand satisfaction, praise, attraction, market popularity, and profitability"(Ledwith et al., 2008; Dogbe et al., 2021) ($\alpha=0.899$).

3.3 Control variables

Relevant studies in the field of new product development and innovation management have shown that firm size, Corporate Age, and industry characteristics (Dogbe, 2021) may affect the performance of new product development, so this study introduces three control variables: firm size, firm age, and industry characteristics.

(1) Enterprise scale. The size of the enterprise affects the stability of the organization, and the more stable the company will be committed to the employee base (Kohtamäki et al., 2021), so the size of the enterprise can be measured by the number of employees. (2) Enterprise age. Business age refers to the number of years that a business has experienced from its inception to 2022. Innovation is a cumulative process that requires companies to continuously invest a lot of resources and technology (Zeng Deming, 2019). As an important indicator reflecting the number and experience of new product development in the past, the age of the enterprise will affect the direction and effect of subsequent new product development. (3) Industry. According to the United Nations Standard Industrial Classification, the types of industries can be divided into primary industry, secondary industry and tertiary industry. The industries to which enterprises belong need to be controlled because different industries have some unique characteristics that may affect the digitization and new product development activities of enterprises (Dogbe, 2021).

4 Results

In table 2, the effect of DS1, DS2 and DS3 was positively associated ($\beta=0.563$, $\beta=0.462$, $\beta=0.466$, $p<0.05$) with NPD. Our Hypothesis 1 is thus supported.

In Table 3, the interaction term (DS1xET, DS2xET, DS3xET), were all negative and insignificant. The effect of DS1xET on NPD was -0.102, the effect of DS2xET on NPD was -0.141, the effect of DS3xET on NPD was -0.133, implying that at higher levels of ET, the positive effect of DS of NPD decreases. Our Hypothesis 2 is thus supported. The moderating effect of EIL on the relationship between DS and NPD was also presented in Models. In Table

5, we notice that the interaction term (DS1x EIL, DS2x EIL, DS3x EIL), were all positive and significant. The effect of DS1x EIL on NPD was 0.13, the effect of DS2x EIL on NPD was 0.104 and the effect of DS3x EIL on NPD was 0.134, implying that at higher levels of EIL, the positive effect of MDS of NPD increases. Our Hypothesis 4 is thus supported.

Table 2 Multilevel moderated regression results

	path		Normalization coefficients	Non-normalized coefficients	S.E.	C.R.	P	hypothesis
NPD	<---	DS1	0.389	0.353	0.064	5.474	***	support
NPD	<---	DS2	0.218	0.233	0.073	3.202	0.001	support
NPD	<---	DS3	0.268	0.267	0.061	4.347	***	support

Table 3 moderation analysis results

Variables	Model 1 NPD	Model 2 NPD	Model 3 NPD	Model 4 NPD	Model 5 NPD	Model 6 NPD	Model 7 NPD	Model 8 NPD
Age	0.073	0.079	0.045	0.048	0.041	0.045	0.002	0.005
Size	0.079	0.077	0.028	0.028	0.091	0.081	0.038	0.046
Industry	0.004	0	0.005	-0.004	-0.003	0.006	0	-0.004
ET	-0.197***	-0.197***	-0.176**	-0.166**				
DS1*ET		-0.102*						
DS2*ET			-0.141**					
DS3*ET				-0.133*				
EIL					0.262***	0.273***	0.342***	0.319***
DS1*EIL						0.143**		
DS2*EIL							0.104*	
DS3*EIL								0.134***
R ²	0.363	0.374	0.276	0.27	0.387	0.405	0.348	0.332
△ R ²	0.037	0.01	0.02	0.017	0.061	0.018	0.01	0.017
F	32.435***	28.139***	17.939***	17.47***	35.918***	32.094***	25.133***	23.431***

Notes: ***P-value significant at 0.1% (0.001).

**P-value significant at 1% (0.01).

*P-value significant at 5% (0.05).

5 Discussion

5.1 Theoretical contribution

In the context of digital economy development, this paper combines MDS with NPD performance, which provides a new research perspective for product innovation research. Starting from the vigorous development of the digital economy and the inevitable and difficult digital transformation, this paper constructs a model of the impact of MDS on the performance

of new product development under the background of digital economy based on the theory of IT business value. This paper conducts research on the digital support of enterprise marketing, conceptual model, theoretical hypothesis, and hypothesis testing of enterprise MDS, new product development performance. The results of the main effect test not only enrich the research on the relationship between digitization and product innovation, enrich the empirical research of IT business value theory, but also make a theoretical response to the question of "where and how to turn marketing digitization" raised by scholars from the perspective of marketing digitization.

In addition, previous studies have focused on the impact of ET on the new product development process (Calantone et al., 2003; Ho et al., 2020) and the moderating role of EIL between knowledge acquisition and innovation ability (WangZongjun et al., 2020), but few scholars have explored the moderating role of ET and EIL in MDS and new product development performance from the two levels of enterprise external environment and internal human capital. Therefore, this study adds the influencing factors of ET and EIL as moderating variables to the main model, which not only expands the research of ET and EIL in the field of digitization and enterprise innovation, but also enriches the empirical research of IT business value theory.

5.2 Managerial implications

The theme of this paper is the impact of MDS on the performance of new product development, and the moderating role of ET and EIL in this process is studied. The corresponding research conclusions have a certain enlightening effect on the digital transformation of marketing links and improving the performance of new product development. First of all, digital sales support, digital service support and data analysis support have a positive role in promoting the performance of new product development, which requires enterprises to build a digital marketing support system. Second, enterprises need to adjust product innovation strategies in a timely manner according to environmental changes and establish a risk early warning mechanism. Finally, the improvement of employees' information literacy is a gradual process, which needs to be gradually realized through a certain training model (Wang Zongjun, 2009).

5.3 Limitations and suggestions for further research

First of all, in terms of concept definition, due to the late start of marketing digitization research in China and less targeted research, this paper draws on more foreign research results from the digital field, IT field, marketing field and other fields, so in the process of concept translation and knowledge transfer, it may cause unclear explanation.

Secondly, in terms of questionnaire measurement and filling, the valid questionnaire data in this study is 290 and the questionnaire items are 29 questions, although it has met the requirements of reliability and validity test in the statistical sense, but the questionnaire data is cross-sectional data, so it cannot eliminate the possible accidental relationship between various latent variables, nor can it reflect the dynamic characteristics of digital update iteration of enterprises. In terms of filling out the questionnaire, due to the high degree of specialization of the research content, some ordinary employees may have deviations in the understanding of the problem but cannot get timely feedback, resulting in deviations in the final results.

Finally, the sample of this study is mainly limited to Zhejiang Province, but in recent years, Guangzhou, Jiangsu, Shanghai, Anhui and other provinces have introduced a series of policies

to promote the digital transformation of enterprises, and have achieved good results. Therefore, the research sample can be expanded to these places in the future.

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