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Online Channel Usage and Product Innovation? The Moderating Effects of Inter-Organization Interactions

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ABSTRACT

With the development of internet, the use of online channels has become a hot issue in manufacturing industry. However, there are hardly any researches have studied the relationship between the innovation of manufacturing enterprises and their use of online channels. This study conducts a hierarchical regression on the basis of 116 answer sheets answered by different employees working in different manufacturing enterprises as research objects, and analysis. The results suggest that the online channel usage of a manufacturing enterprise will have a positive effect on its practice of incremental innovation and the interaction between the company of its customers will be a partial mediator. The results also indicate that the online channel usage of a manufacturing enterprise will have a positive effect on its practice of radical innovation and the interaction between the company of its customers will be a partial mediator.

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Introduction

Comparing with traditional offline channels, online channels have many unique advantages. Online channels break the restrictions of time and space, which increases the accessibility of products, and also stimulate consumers' consumption desire. Online channels play a very positive role in expanding the market, increasing sales and improving corporate performance. In addition, with the popularity of the Internet, especially the development of mobile internet in recent years, online shopping has become increasingly popular. More and more consumers choose to shop online, which has attracted the attention of traditional manufacturing enterprises. Many manufacturing enterprises have changed their traditional sales channels and built online channels. However, many enterprises are not fully sure how this change will affect their innovation capability. Therefore, it is urgent to study on online channel usage and manufacturers' product innovation.

The issues of product innovation in the online market seems to be ignored by scholars who still focus on the traditional market [1,2]. This study combines the channel usage of manufacturing enterprises with product innovation, and provides a theoretical and practical basis for manufacturing enterprises to understand market changes, formulate channel strategy and select product innovation types, which is beneficial to the healthy development of manufacturing enterprises. The main content of this paper is the relationship between manufacturer's online channel usage and product innovation, and takes the interaction between manufacturer and user as the mediator variable.

Literature Review

Online Channel

Online channel, also known as Internet based online channel or e-marketing channel is a concept corresponding to the traditional offline channel. Combined with the definitions of Zwass and Rosenbloom this paper defines online channel as "sharing information through the Internet, establishing and maintaining relationships with target consumers, so that target consumers can use computers or other intelligent terminals to shop and complete purchase transactions" [3-6].

Online channels can be divided into two categories: indirect online channels with intermediaries and direct online channels without intermediaries. The online channel referred to in this paper is the latter, that is, direct online channel. In such online channels, consumers can use the Internet to order products directly from product producers (i.e., manufacturers), and manufacturers can directly accept consumers' order applications through the Internet.

The studies on online channels are mainly from the perspective of enterprises and distributors, focusing on the fields of channel conflict, channel substitution and the impact on enterprise performance, to provide suggestions for the choice of channel strategy.

Marketing channel is the mechanism of communication, service delivery and transaction completion. Under the condition of traditional offline channels, the communication function of channels is difficult to give full play to. With the help of the special attributes of the network, online channels, on the one hand, break the restrictions of space and facilitate the contact between channel suppliers (especially manufacturers) and demanders. On the other

hand, they can provide a lot of useful information for consumers' purchase decisions and deeply participate in the whole process of consumers' consumption decisions.

Online channels have changed or expanded the functions of channels [7,8]. With the integration of online channels and offline channels, the existing channel concept has been similar to the concept of consumer contact point. Neslin et al. directly defined channel as customer contact point/customer touch point, and believed that channel is the intermediary of interaction between enterprises and consumers, and consumer contact point is an opportunity for communication and interaction between enterprises and their current or potential consumers. In their definition, they especially emphasize "interaction", that is, the communication between enterprises and consumers in the channel is two-way [9].

Under the influence of the increase of channel types and the change of channel functions, the concepts of multi-channel management and multi-channel customer management came into being. Multi-channel consumer management is defined as "the design, deployment, coordination and evaluation of the channels between enterprises and consumers. The purpose of multi-channel consumer management is to increase the value of consumers through effective customer acquisition, retention and development". The research of Rangaswamy shows that different from the traditional sales channels that only focus on the completion of enterprise distribution function, multi-channel customer management actually takes the customer as the marketing function of the center, and realizes the purpose of increasing enterprise value by creating customer value [10,11].

With the development of network technology (especially mobile Internet), online channels themselves have been expanded, and multi-channel has gradually evolved to Omni channel. The concept of Omni channel management has also been put forward on the basis of multi-channel management. Qi and Zhang believe that omni-channel is consistent with multi-channel, both of which are consumer centered and focus on consumer experience. In the context of Omni channel, every consumer can enjoy undifferentiated services in any channel Verhoef et al. believe that in the context of Omni channel, different channels can interact and be used at the same time. They define Omni channel management as "collaborative management of unclear channels and consumer contact points, so as to enable consumers to get the best channel experience and optimize channel performance". The formation of the concept of Omni channel and omni channel management has further expanded the concept category of channel and integrated thinking on the interaction between enterprises and consumers [12,13].

The change of channels has directly brought about the change of consumption environment, and consumers and their consumption behavior have also changed. Under the background of traditional offline channels, consumers' channel choices are very limited, and they are unable to obtain enough information about product quality, performance and price. Serious information asymmetry limits consumers' ability to choose independently. At the same time, when consumers feel that they are being treated unfairly or dissatisfied with products and services, they can choose to stop buying again, complain or spread negative comments, but the influence of their above behaviors is very weak, which is difficult to attract the attention of enterprises and urge enterprises to make changes. However, with the establishment of online channels and the advent of the era of multi-channel and even

Omni channel, the situation of lack of information and influence of consumers has been improved. The research of Berry et al. shows that the power balance of producers (manufacturers), sellers and consumers of products and services has changed, and the Internet has greatly improved consumers' ability to search for information and evaluate. The empirical research of Shi shows that consumers' ability to comprehensively utilize various channels is increasing, and their consumption behavior is changing continuously. Li defined consumers in the current channel environment as "Omni channel consumers" based on Omni channel theory. He believes that current omni-channel consumers will use a lot of distribution, information and logistics channels in each purchase process, and omni-channel consumers will tend to try new distribution, information and logistics channels in multiple purchases. When enterprises can not well meet and meet the needs of omni-channel consumers, consumers will find it difficult to find their products and services in many channels, and the relationship between them will become fragile and alienated, and even the original loyal customers will disappear [12,14,15].

To sum up, the emergence and development of online channels have had a great impact not only on the channel itself, but also on its main participants. On the one hand, the use of online channels blurs the boundary between manufacturers and distributors, pushes manufacturers to consumers, and creates more opportunities for contact between the two; On the other hand, the new channel environment promotes the transformation of consumers and their consumption behavior, and the channel power further tilts to the demand side, pulling manufacturers to consumers.

Product Innovation

A large number of strategic management literature and research in related fields have discussed the major proposition of enterprise innovation. Myers and Marguis regarded innovation as a collection of enterprise technological changes, while Utterback et al. regarded innovation as the actual adoption or first application of technology. Innovation includes model innovation, product innovation and other aspects. The research focus of this paper is on product innovation [16-18].

Product innovation, sometimes called design innovation or technological innovation, is the change of design attributes such as technology, quality, appearance and structure relative to the current products of the enterprise. To understand product innovation, we must first clarify what kind of products can be called "new products". This paper adopts the definition of new products by Ji and Wang that is, new products are products that enterprises have never sold or appeared in the market. Secondly, new products also need to have the characteristics of adding value to consumers or reducing unit production costs and bringing competitive advantages to enterprises. The number of new products launched by enterprises and the difference between new products and original products can reflect the product innovation level of enterprises [19,20].

According to the degree of innovation, the product innovation of enterprises can be divided into two categories: breakthrough product innovation and gradual product innovation. Tushman and Romanelli distinguished these two innovations. Radical innovation, also known as exploratory innovation, is a large-scale and exploratory innovation behavior, which emphasizes the acquisition and creation of new knowledge and technology. The purpose is to explore and meet the implicit needs of existing customers, or meet the needs of new customers and new markets.

Incremental innovation, also known as exploitative innovation or continuous innovation, is a small-scale and exploitative innovation behavior, which emphasizes refining, integrating and improving existing knowledge and technology and expanding the boundary of existing technologies or methods, in order to meet explicit customer needs and bring better services to existing customers. These two types of innovation compete for the resources of enterprises and bring different competitive advantages to enterprises. Radical innovation can bring long-term competitiveness to enterprises, create new markets and even subvert the industry. However, the results of radical innovation are uncertain (usually more likely to fail), and products need a long time to be introduced to the market and accepted; Incremental innovation can help enterprises gain advantages in the current competition. Compared with radical innovation, the effect and impact of incremental innovation are more direct, rapid, short and mild [21,22].

Although there are many differences between radical innovation and incremental innovation, the relationship between them is very close. At a specific time, the product innovation of an enterprise or even an industry may only be one of radical innovation or incremental innovation. However, when we lengthen the time span and look at product innovation from the perspective of process, we will find that incremental innovation and radical innovation appear alternately and influence each other, and incremental innovation accumulates energy for radical innovation, non regular radical innovation opens up new fields for incremental innovation. Together, they lead enterprises, industries and even society to a new level of innovation.

Schumpeter put forward the innovation theory in 1912. In the following decades, the research related to innovation mainly experienced three stages of development. The 1950s was the founding age. The research in this stage mainly focused on the decomposition of innovation theory and the discussion of technological innovation theory; The 1970s was the second stage, which mainly carried out the systematic development of technological innovation theory; In the 1980s, the comprehensive and specialized research on technological innovation theory has become the mainstream of academic research at this stage. Among them, the specialized research on technological innovation theory leads to the requirement of systematic research on product innovation management. At present, the research on product innovation management at home and abroad mainly focuses on the connotation of product innovation, the success or failure of new products, product innovation organization, product strategy, strategic evaluation and product innovation performance. Based on the consideration of research theme and research direction, this paper mainly reviews the relevant literature on the factors affecting enterprise product innovation (especially the types of product innovation).

There are many factors affecting product innovation, among which strategic orientation is regarded as an important driving factor of product innovation. Strategic orientation reflects the philosophy of business activities and is the value and belief that guides enterprises to pursue excellence. As an important dimension of strategic orientation, market orientation has always been regarded as an important antecedent variable of enterprise innovation. Narver and Slater, Kohli and Jaworski respectively explain the concept of market orientation from two different perspectives of culture and behavior. Generally speaking, market orientation mainly includes three basic components: consumer orientation, competition and coordination orientation between functions.

Customer orientation emphasizes that enterprises should fully understand their consumers and continue to create excellent value for consumers; Competition orientation means that enterprises should understand their current and potential main competitors, and clarify their short-term advantages and disadvantages, as well as their long-term capabilities and strategies; Inter functional coordination emphasizes that enterprises create value for target consumers by coordinating enterprise resources. With the development of time and the change of market, the connotation of market orientation has been updated and expanded, but its core has not changed, that is, it emphasizes that enterprises are close to the market and consumers are placed at the top of the enterprise organizational structure [23].

Conceptual Model and Hypothesis Development

Conceptual Model

The main effect of this paper is the relationship between manufacturers' online channel usage and two types of product innovation, and the interaction between manufacturers and consumers is introduced as an intermediary variable. In addition, this paper also takes the types of products produced by manufacturers and their market share as control variables, and discusses the potential regulatory role of these control variables on the main effect. The research model established in this paper is shown in Figure 1.

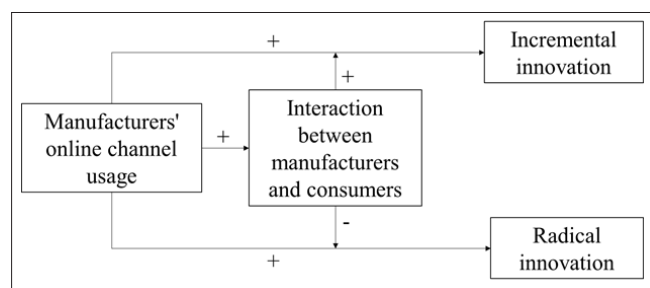


Figure 1: Conceptual model

Hypothesis Development

The relationship between manufacturers' online channel usage and product innovation With the development of Internet technology, the types and functions of channels have become richer, the relationship with products has become closer and more complex, and the impact on products has become more and more significant. Proposed from the perspective of organizational learning theory that in the e-commerce market, market information positively affects the product innovation tendency of enterprises. The more comprehensive market information enterprises master, the stronger the tendency of enterprises to carry out product innovation. Compared with traditional offline channels, manufacturing enterprises can better grasp the sales situation of products by using online channels, and the changes of product demand can be more directly, quickly and accurately reflected to the supply side (i.e., manufacturers) through online channels. On the one hand, it facilitates the adjustment of manufacturers' production, and more importantly, it provides directions for manufacturers to upgrade and improve their products. In recent years, the iterative speed of many products that have opened up online sales channels in society is much faster than before, which confirms this view from the perspective of practice. The adjustment, upgrading and iteration of products based on the original products are the characteristics of progressive product innovation.

Based on the above discussion, this paper puts forward hypothesis H1a.

H1a: Manufacturers' use of online channels is positively related to their progressive product innovation.

Hu et al. used the novelty and uniqueness of new products to measure enterprise product innovation, and these two characteristics are more obvious in breakthrough innovative products. The products born through radical innovation usually have brand-new characteristics, which are very different from the previous products of the enterprise, or even completely different from the existing products in the market. This trait requires consumers to pay enough time and energy to learn, so as to fully understand the attributes and use methods of the product, prolong the time for market diffusion of new products, and increase the process and risk for enterprises to obtain benefits. This is an important reason why many enterprises are unwilling to carry out breakthrough product innovation. The use of online channels alleviates this problem. First of all, the use of online channels can quickly show new products to the majority of consumers, improve consumers' exposure to new products, shorten the time for market diffusion of new products, improve the market acceptance of breakthrough innovative products, and increase the success rate of breakthrough innovative products to a certain extent. The use of online channels reduces the risk of breakthrough product innovation and enhances the confidence and willingness of enterprises to carry out breakthrough product innovation [24].

Based on the above discussion, this paper puts forward hypothesis H1b.

H1b: Manufacturers' use of online channels is positively related to their breakthrough product innovation.

Relationship between Manufacturer's Online Channel use and Interaction

Scientific and technological progress has created more opportunities for the interaction between enterprises and consumers, between enterprises and enterprises, and between consumers and consumers, especially between enterprises and consumers. From the perspective of enterprises, many scholars have studied the interaction between enterprises and consumers. They understand it as the contact and communication between enterprises and consumers, and emphasize that enterprises can deeply understand consumers, establish close relations with consumers and create excellent value for consumers by contacting consumers and encouraging consumers to participate. On this basis, the concept of interaction orientation came into being. Ramani and Kumar complete the concept of interaction orientation. They believe that the core of interaction orientation lies in the attention of enterprises to consumers, which is embodied in the concept (consumer concept) and the relevant process of implementing the concept (response), practice (consumer authorization and consumer value management). The interaction between enterprises and consumers is a two-way process. The use of manufacturers' online channels also affects the interaction between enterprises and consumers from the perspectives of manufacturers and consumers [25].

Firstly, the use of manufacturers' online channels creates more opportunities for enterprises to directly contact and communicate with consumers. At the same time, the convenience of objective conditions encourages manufacturers to approach and understand consumers. Under the background of traditional offline channels, due to the influence of cost control and other factors, manufacturers mostly need to sell products with the help of distributors and retailers, and do not face consumers in person. Manufacturers need to spend energy and resources, such as conducting research

and holding market activities, to create conditions for interaction between themselves and consumers. Using online channels, manufacturers come to the stage, display product information and obtain consumer evaluation through e-commerce platforms, and reach every consumer with the help of service links such as customer service. Online channels reduce the cost and difficulty for manufacturers to contact and understand consumers, master consumer preferences and behaviors, and play an increasingly prominent role in cost control and increasing sales and profits, stimulating manufacturers to get close to and understand consumers.

Secondly, from the perspective of consumers, the use of manufacturers' online channels allows consumers to directly feedback their opinions to manufacturers or make online comments, and receive timely feedback. In this process, consumers are aware of their influence on manufacturers and are satisfied, encouraging their willingness to participate, and the level of interaction between the two is further improved.

Based on the above discussion, this paper puts forward the hypothesis H2.

H2: Manufacturers' online channel usage has a positive impact on their interaction with consumers.

The Relationship between Interaction and Product Innovation

To some extent, the interaction between enterprises and consumers has something in common with market orientation. They all have the connotation of paying attention to consumers, obtaining and using consumer demand and other information. Like market orientation, in the research of many scholars, the interaction between enterprises and consumers is also regarded as an important leading variable of enterprise product innovation. For example, Gardiner and Rothwell found that the interaction between enterprises and consumers with broad knowledge and sometimes strong strength can provide information for enterprises through the method of case study [26].

These consumers will even directly participate in the innovation process and improve the innovation level of enterprises. At the same time, as mentioned above, the definition of interaction between enterprises and consumers in this paper has been expanded on the basis of the original research, and further strengthened its relationship with enterprise product innovation. Specific to the impact of the interaction between enterprises and consumers on the types of enterprise product innovation, combined with relevant research and practical cases, this paper makes the following analysis and judgment.

The interaction between enterprises and consumers is conducive to the incremental innovation of enterprises. Through interaction with consumers, enterprises can fully grasp consumer information and better understand consumers' dissatisfaction and pain points with existing products. However, due to the limited knowledge of consumers, they often only focus on the current feelings, which are often explicit, short-term and lack of forward-looking needs. Under the guidance of this demand, enterprises often improve and upgrade their existing products, that is, progressive innovation. The higher the degree of interaction between enterprises and consumers, the more trivial but real, useful but limited insight they get, and the easier it is to judge progressive innovation.

The interaction between enterprises and consumers is not conducive to radical innovation. Firstly, from the perspective of resource theory, there is resource competition between progressive innovation and radical innovation in enterprises.

The interaction between enterprises and consumers enhances the focus of enterprises on incremental innovation, which will inevitably damage their investment in radical innovation and have an impact on radical innovation. In addition, the process of interaction between enterprises and consumers is the process of enterprises moving towards consumers.

In this process, enterprises continue to improve their understanding of consumers. More importantly, enterprises need to make timely and accurate responses to consumers' feelings and needs. With the increase of the degree of interaction between the two, consumers have more and more requirements for enterprises. Enterprises are easy to blindly meet the needs of consumers and lose their initiative. In fact, the performance of many enterprises is a vivid reflection of this problem. In February 2018, ASUS released the new flagship model ZenFone 5 / 5Z, and the appearance and function of ZenFone 5 are very similar to iPhone x, especially the "bangs" design of the screen. In the face of media questions about plagiarism, Marcel Campos, head of global product marketing of ASUS, gave this answer: ASUS cannot ignore (or have to) meet the needs of users, so it follows this product trend to develop. Based on the above discussion, this paper puts forward the assumptions h3a and H3b.

H3a: the interaction between manufacturers and consumers has a positive impact on manufacturers' incremental innovation.

H3B: the interaction between manufacturers and consumers has a negative impact on manufacturers' radical innovation.

Methodology

Measurement

In order to ensure the reliability and validity of the measurement, the scale used in this paper is mainly based on the scale used in domestic and foreign research, and then modified appropriately in combination with the research purpose of this paper as a tool to collect empirical data. Among them, the scales of progressive product innovation and breakthrough product innovation mainly refer to the scales used by Li Yihe, Si Youhe and Zhang Jing and Duan Yanling. The interaction between enterprises and consumers mainly refers to the scales used by Zhang Jing, Duan Yanling and Li Wei. For the variable of manufacturers' online channel usage, this paper develops a new scale based on literature review and practice. All scales adopt the Likert scale of 7-point system. The respondents score each item according to their understanding of the enterprise in which they work, indicating their recognition of the description of the item. Where, "1" indicates complete non-compliance and "7" indicates complete compliance [13,27-30].

From the perspective of industrial economics, many scholars have explored the reasons affecting enterprise product innovation. The results show that market structure, market scale and other factors will affect the performance and type selection of enterprise product innovation to some extent. Combined with other relevant studies, the type of products produced by manufacturing enterprises and their market share in the industry will affect their dependence on the market (or consumers) and their enthusiasm for innovation. Therefore, this study takes the type of products produced by manufacturers and market share as control variables. Among them, the product types are divided into three categories: industrial products, fast-moving consumer goods and durable consumer goods, and the market share is measured by real values.

Data Collection

A total of 120 questionnaires were collected in this study, because most of the questions in the questionnaire are set as required questions, and there are no missing questions in the questionnaire.

This study mainly takes two factors as the elimination criteria of the ineffective questionnaire: whether the questionnaire answers have obvious regularity and the answer to the reverse questions. After careful screening, a total of 116 valid questionnaires were obtained, which constituted the sample of this study.

Table 1 summarizes and displays the basic descriptive statistical results of the sample. Two points deserve special attention: first, the proportion of respondents from the market and R & D departments in the sample is high, 24.1% and 32.8% respectively. Within the enterprise, the staff of these two departments have more contact with the main variables of this study (channel use, consumer interaction and product innovation), have a deeper understanding of the questions in the questionnaire, and the answers provided can better reflect the real situation of the enterprise; Second, 72.4% of the respondents in the sample are enterprise managers, who have a comprehensive grasp of enterprise information. The above two characteristics improve the quality of questionnaire data and provide a useful guarantee for the quality of samples and the effectiveness of research results to a certain extent.

Table 1: Profile of Samples

Variables	Sample	%
Product type		
Fast moving consumer goods	15	12.9
Durable consumer goods	31	26.7
Industrial product	70	60.3
Company size (number of employees)		
>1000	85	73.3
300~1000	14	12.1
20~300	16	13.8
<20	1	0.9
Annual revenue (million RMB)		
>50000	89	76.7
2000~50000	19	16.4
500~2000	6	5.2
<500	2	1.7
Market position		
Leader	50	43.1
Challenger	39	33.6
Follower	19	16.4
Nicher	8	6.9
Degree of market competition		
Perfect competition	77	66.4
Monopolistic competition	26	22.4
Oligopoly	11	9.5
Complete monopoly	2	1.7
Respondent position		
Front line staff	32	27.6
Grassroots managers	57	49.1
Middle managers	23	19.8
Senior managers	4	3.4
Sample size	116	

Hypothesis Test

In this paper, the principal component analysis method is used to conduct confirmatory factor analysis on each main variable. The final number of factors extracted and the eigenvalue is greater than 1 as the criterion. At the same time, the reliability and validity of each variable are tested on the basis of factor analysis. The test results show that the Cronbach's alpha coefficient of each variable is greater than 0.8 (the specific values are 0.856, 0.898, 0.940 and 0.950 respectively), indicating that the internal consistency between the items corresponding to each variable is very high. The scale used in this paper has passed the reliability test. At the same time, the KMO values corresponding to each variable in this paper exceeded 0.7, and the values of Bartlett spherical test also met the requirements of significance level ($P < 0.01$), indicating that the validity of the scale is good and suitable for factor analysis. In addition, the factor load of all items on their variables in the scale is higher than 0.5, which is worth retaining. Table 2 lists the test results of the measurement methods and the reliability and validity of each variable.

Table 2: Measurement, Reliability and Validity of Variables

Variables	Factor loading	Cronbach's Alpha	KMO	Bartlett spherical test	
				Bartlett spherical test value	Degree of freedom
Radical innovation		0.856	0.778	311.871**	15
B1	0.715				
B2	0.721				
B3	0.798				
B4	0.812				
B5	0.814				
B6	0.720				
Incremental innovation		0.898	0.902	555.015**	36
C1	0.559				
C2	0.754				
C3	0.783				
C4	0.808				
C5	0.606				
C6	0.810				
C7	0.809				
C8	0.863				
C9	0.734				
Online channel usage		0.940	0.892	1029.525**	28
E1	0.589				
E2	0.747				
E3	0.791				
E4	0.937				
E5	0.939				
E6	0.913				
E7	0.905				
E8	0.876				
Interaction		0.950	0.908	1062.74**	36
G1	0.73				
G2	0.726				
G3	0.859				
G4	0.864				
G5	0.884				
G6	0.917				
G7	0.907				
G8	0.915				
G9	0.794				

** $P < 0.01$; * $P < 0.05$.

In this paper, the variable of product category is treated as a virtual variable, in which the value of consumer goods is “0” and the value of industrial products is “1”; The variable of market share is counted according to the actual proportion of sample enterprises in the industry (0 ~ 100%), which is a continuous variable, so it does not need special treatment. Table 3 shows the mean, standard deviation and correlation coefficient of each variable.

Table 3: Descriptive Statistic and Correlation Analysis Results

	Radical innovation	Incremental innovation	Online channel usage	Interaction	Product type	Market share
1	1					
2	0.649**	1				
3	0.532**	0.416**	1			
4	0.527**	0.710**	0.315**	1		
5	-0.063	0.045	0.067	-0.002	1	
6	0.224*	0.260**	0.210*	0.274**	-0.045	1
Mean	4.590	5.168	4.109	5.400	0.600	0.310
SD	1.270	1.078	1.663	1.258	0.491	0.257

** P<0.01; * P<0.05; N=116

This study mainly uses SPSS 24.0 to test the hypothesis of hierarchical regression. In these eight models, the variance expansion factor (VIF value) of the independent variables is between 0-10, which excludes the possibility of multicollinearity among the variables in the model. In addition, the DW values of each model are between 1.5-2.5, and there is no multicollinearity. Table 4 lists the regression results of each model.

Table 4: Results of Hypothesis Test

	Interaction		Incremental innovation			Radical innovation		
	M1	M2	M3	M4	M5	M6	M7	M8
Controls								
Product type	0.010	-0.010	0.028	0.049	0.034	-0.092	-0.058	-0.088
Market share	0.274**	0.217*	0.182*	0.074	0.045	0.112	0.083	0.027
Independent								
Online channel usage		0.270**	0.376**		0.205**	0.514**		0.409**
Mediator								
Interaction				0.69**	0.633**		0.505**	0.391**
R Square	0.059	0.121	0.184	0.498	0.531	0.286	0.269	0.415
R Square Change	0.075	0.144	0.205	0.511	0.548	0.304	0.288	0.435
F Value	4.587*	6.293**	9.620**	38.985**	33.603**	16.322**	15.133**	21.387**
DW	1.875	2.005	2.041	2.132	1.986	2.106	2.139	2.031

Main Effects Test

In hypothesis H1a, this paper proposes that manufacturers’ online channel usage has a positive impact on enterprises’ progressive product innovation. Model 3 takes progressive product innovation as the dependent variable, adds product type and market share as the control variable, and finally adds the independent variable (manufacturer’s online channel use) into the equation. The model results show that manufacturers’ online channel usage has a very significant positive impact on enterprises’ incremental product innovation (M3, $\beta = 0.376$, $P < 0.01$), assuming that H1a is supported.

In hypothesis H1B, this paper proposes that manufacturers’ online channel usage has a negative impact on enterprises’ breakthrough product innovation. Model 6 takes breakthrough product innovation as the dependent variable, and adds the control variable (product type, market share) and independent variable (manufacturer’s online channel use) into the equation. The model results show that manufacturers’ online channel usage has a very

significant positive impact on breakthrough product innovation (M6, $\beta = 0.514$, $P < 0.01$), which is consistent with the prediction of the relationship between them by hypothesis H1b. Therefore, hypothesis H1b is supported.

Mediator Role Test

This paper uses the method of hierarchical regression to verify the mediator role of enterprise consumer interaction between manufacturer’s online channel use and progressive product innovation, and the mediator role of enterprise consumer interaction between manufacturer’s online channel use and breakthrough product innovation.

Impact of manufacturer’s online channel use on enterprise consumer interaction (m2, $\beta = 0.270$, $P < 0.01$), progressive product innovation (M3, $\beta = 0.376$, $P < 0.01$). After adding the interaction between enterprises and consumers as an intermediary variable, manufacturers use online channels to carry out progressive product innovation for enterprises (M5, $\beta = 0.205$, $P < 0.01$), while the

interaction between enterprises and consumers leads to progressive product innovation (M4, $\beta = 0.690$, $P < 0.01$). The above results show that the interaction between enterprises and consumers plays a partial mediator role between the manufacturer's online channel use and its progressive product innovation. At the same time, it also supports hypothesis H2 and hypothesis H3a.

Impact of manufacturer's online channel use on enterprise consumer interaction (m2, $\beta = 0.270$, $P < 0.01$), breakthrough product innovation (M6, $\beta = 0.514$, $P < 0.01$). After adding the interaction between enterprises and consumers as an intermediary variable, manufacturers use online channels to carry out breakthrough product innovation (M8, $\beta = 0.409$, $P < 0.01$), while the interaction between enterprises and consumers leads to breakthrough product innovation (M7, $\beta = 0.505$, $P < 0.01$). The above results show that the interaction between enterprises and consumers plays a partial mediator role between the manufacturer's online channel use and its progressive product innovation, which supports hypothesis H2, but Model 7 shows that the interaction between enterprises and consumers makes breakthrough product innovation for enterprises (M7, $\beta = 0.505$, $P < 0.01$), which is contrary to the hypothesis that H3b is not tenable.

The research results of this paper support the hypothesis of the relationship between manufacturers' online channel usage and two types of product innovation, and the influence mechanism of manufacturers' interaction with consumers as an intermediary. To a certain extent, it shows the rationality of the logic used in this paper to demonstrate the above hypothesis, that is, it supports the views that the channel function is changing and consumers (or the market) are an important source of product innovation. In addition, the research results show that consumer interaction plays a partial mediator role in the impact of manufacturers' online channel usage on the two types of product innovation. This conclusion reflects that manufacturers' online channel usage may also affect enterprises' progressive product innovation and radical product innovation through other factors.

Conclusions

The findings firstly show that manufacturers' use of online channels has a positive impact on their progressive product innovation. The higher the degree of manufacturers' use of online channels, the stronger their willingness and action to carry out progressive product innovation; Introducing the interaction between enterprises and consumers as an intermediary variable improves the explanatory power of the model, and explains that the interaction between enterprises and consumers plays a partial mediator role in the manufacturer's online channel use and its progressive product innovation, that is, the manufacturer's online channel use affects its progressive product innovation through the interaction between enterprises and consumers.

Secondly, manufacturers' use of online channels has a positive impact on their breakthrough product innovation. The higher the degree of manufacturers' use of online channels, the stronger their willingness and action to carry out breakthrough product innovation; Introducing the interaction between enterprises and consumers as an intermediary variable improves the explanatory power of the model, and shows that the interaction between enterprises and consumers has a partial intermediary effect on the manufacturer's online channel use and its breakthrough product innovation, that is, the manufacturer's online channel use affects its breakthrough product innovation through the interaction between enterprises and consumers.

Limitation and Further Research

This study still has some limitations in the following aspects. First of all, the sample size is limited, and the sample size and industry coverage can be increased in the future. Secondly, manufacturers' use of online channels, interaction with consumers and innovation are dynamic processes, and panel data should be used in future research. Finally, online channels bring increment to manufacturers in the period of rapid development, which makes manufacturers benefit from many aspects. However, in the mature period of online channels, the relationship between online channel use and product innovation may change. Future research should dynamically track and verify this relationship.

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