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Determinants of Reverse Innovation Path Selection for Emerging Companies

Li Wei[1] and *Liu Zhi*[2]

[1]School of Economics and Management, Chongqing University of Posts and
Telecommunications, Chongqing 400065, China.
[1]Email: liweicem@cqupt.ecu.cn; [2]Email: liuzhi1223@qq.com
[1]Corresponding author

Abstract. Reverse innovation, refers to an emerging concept of innovation, in which the new product R&D is executed and completed in developing countries while the new product finally enters developed country market successfully. Based on the theoretical framework of innovation chain, and referring to the whole process of reverse innovation chain, the research explored the key factors impacting the selection of reverse innovation path. With carefully selection on typical reverse innovation cases and collection of relevant data, 43 products with successful reverse innovation performance were finally gathered. Findings were revealed based on logistic regression analysis. It was illustrated that the source of innovation ideas, firm's technological capacity, and the innovation extent impact the selection of reverse innovation path significantly. Firstly, market source of innovation ideas is a significant determinant of reverse innovation path selection. It is demonstrated that if the product's innovation idea originated from oversea market, the emerging firm would tend to choose the developed market as the original market while the developing markets would be the secondary markets. Secondly, firm's technological capacity played a significant positive role on innovation path selection, illustrating that the higher the technological capacity, the higher preference to launch the new product directly in developed markets. Thirdly, the innovation extent is positively associated with if innovation path selection, demonstrating that if the product is featured by exploring innovation, the emerging company would prefer to launch the new product directly in developed markets.

1. Introduction
Traditional positive innovation is initiated by multinational corporations in developed countries, completing original R&D and initial industrialization in developed countries, and then exporting new products to emerging markets. Reverse innovation refers to the innovation activities of latecomer companies that complete new product research and development in the local area based on their ideas, and then successfully export innovative products to markets in developed countries (Immelt et al, 2009). Among them, the completion of R&D in developing countries is the foundation of reverse innovation, and successful entry into the market of developed countries is the ultimate sign of reverse innovation. Up to now, there are two types of enterprises that implement reverse innovation, one is developed country enterprises, and the other is developing country enterprises, so-called emerging companies. Although current reverse innovation activities are mainly initiated by enterprises in developed countries (Govindarajan and Trimble, 2012), more and more scholars have pointed out that latecomer

enterprises in emerging markets are the real main force of reverse innovation. It will become the latest strategic model for latecomer companies to open up markets in developed countries and surpass the world's leading companies (Simone, 2012).

Although scholars have conducted a certain theoretical combing and generalization on the implementation path of reverse innovation in latecomer enterprises, the lack of empirical data testing has become an important flaw in the current research system (Xu Nana and Xu Yusen et al., 2016; Nana and Zhengy in, 2017; Agarwal et al, 2019). Looking at the existing results in the field of reverse innovation research in latecomer enterprises, it can be found that the research methods are highly limited to theoretical speculation and case analysis, and large-scale empirical tests are extremely scarce, resulting in the failure to evaluate the reliability and robustness of the theoretical system constructed. In view of this, based on the theory of international entrepreneurship and innovation chain, this paper explores the influencing factors of the reverse innovation path selection of latecomer companies, collects sample data, and conducts empirical research on the selection method of reverse innovation path of latecomer companies.

2. Literature review and research hypotheses

For developed markets, latecomer companies in emerging countries generally have the dual disadvantages of technology and market. Therefore, the essence of the strategy of latecomer companies to explore developed countries' markets is innovation and entrepreneurship. Based on the theory of international entrepreneurship and innovation chain theory, this article understands the reverse innovation activity of latecomer enterprises as an innovative entrepreneurial activity carried out in the market of developed countries, and this innovation is a link that includes creativity, technology development, and product diffusion. Chain process. Xu Yusen and Xu Nana (2016) pointed out that the two core elements of reverse innovation in latecomer enterprises are creativity and R&D, and based on this, they divide reverse innovation into four types. Simone (2012) pointed out in the research on the reverse innovation model of enterprises in developed countries that whether or not enterprise innovation activities are reverse innovation depends on the country characteristics of entering the market, and based on this, proposed the primary market in the process of product internationalization. And secondary market concepts. Based on the above two conclusions, Li Wei et al. (2020) further researched from the perspective of the innovation chain and pointed out that the reverse innovation of latecomer enterprises is a chain process, and the chain includes three main links: creative source, technological development and market entry sequence. According to the factors of market entry sequence, the reverse innovation path of latecomer enterprises is summarized into two types: market-gradual and market-jumping. Among them, the main feature of the gradual market path is that new products first enter the markets of emerging countries, and then enter the markets of developed countries, while the market leaping path is that late-comer companies use developed countries as primary markets for new products. Market proliferation first occurred in the market of developed countries. Below, this article will study the choice of the reverse innovation path of latecomer companies based on the three links of the reverse innovation chain of latecomer enterprises and the two classification of reverse innovation paths.

The theory of international entrepreneurship believes that it is essential to seek and effectively utilize profitable entrepreneurial opportunities in the international market (Tian Bifei and Ding Qiao, 2017), and entrepreneurial opportunities can be understood as the generation of product ideas. From the perspective of creative sources, there are two main sources of creativity that international entrepreneurial companies rely on for new product design and development, namely domestic market demand and overseas market demand information (Tian Bifei and Dai Lulu, 2019; Huang Sheng et al., 2018). Among them, the local creativity is highly matched with the needs of the home country's target market, and it is

suitable to use emerging markets as the primary market. After product promotion is completed in the home country or other emerging markets, reverse innovative products can be imported into developed countries' niche markets or even mainstream In the market, this process reflects a progressive reverse innovation path (Gao Xudong, 2019). The ideas originating from overseas target markets, such as Haier's freezer ideas, computer desk refrigerator ideas, etc., have good overseas applicability, and even have the characteristics of "customization" and "specificity" in developed countries, which can greatly reduce the market. Localized improvement requirements in the conversion phase, so overseas target markets may also become primary markets for products. After the reverse innovation product is directly promoted in the target country's developed country market and gains a stable market share, the product is then traced back to the home country's home market or other emerging country markets. This process reflects the jump-type reverse innovation path. Accordingly, we propose the following research hypotheses:

Hypothesis 1: The country of origin of product ideas has a significant impact on the choice of reverse innovation paths for latecomers. Specifically, in the case of overseas-sourced ideas, companies are more inclined to choose a leaping path; in the case of local-sourced ideas, companies are more inclined to choose a gradual market path.

The creative integration of corporate international resources is the resource foundation of international entrepreneurship, and technological resources play a vital role in it (Mainela et al, 2014). The technical resources required for R&D activities include its own resources and external cooperation resources, but the basic role is played by the own technical strength that latecomer enterprises have accumulated during the operation process (Yu Xiaoyu, 2013). In terms of the degree of technological innovation, innovation can be divided into exploitation innovation (or product redesign) and exploratory innovation, that is, new products can be application innovations of existing core technologies or the creation of core technologies. However, the choice of the degree of technological innovation is limited by the resource conditions and technological level of the enterprise, and it is necessary to ensure that the degree of innovation matches the technological strength of the enterprise (Wu Weiwei et al., 2017). If an enterprise successfully understands the latest technological trends in the industry, and can rely on its technical strength to design and develop new products, that is, adopt an exploratory technological innovation strategy, the enterprise can obtain the "first mover advantage" of technological innovation, and it will be more likely to directly Participate in international market competition, export its innovative products to the markets of developed countries, and even directly provide product customization services for customers in developed countries, thereby successfully realizing the reverse innovation of new products. If the above exploratory innovation process is realized, latecomer companies will most likely adopt an entry strategy that directly enters the market of developed countries, that is, choose a leap-type reverse innovation path.

However, as latecomer companies, most Chinese companies are still at a technological disadvantage when facing companies in developed countries. Under the severe constraints of technical capabilities, the innovation activities that companies engage in are often digging innovations, that is, targeting existing products. Minor functional improvements or redesigns. In this case, innovative products cannot be sufficiently differentiated and form a competitive advantage in the developed country market. If you choose to directly enter the developed country market, you will inevitably face fierce competition, plus local market knowledge Lack, late-comer companies tend to avoid the markets of developed countries and first choose other emerging countries with similar domestic market conditions for product internationalization. In the later stage, the products will be further optimized to meet the technical quality standards of developed countries, and then the products will be introduced into the market of developed

countries at the right time. This means that latecomer companies that adopt mining innovation are likely to choose a gradual path when opening up markets in developed countries. In summary, we propose the following research hypotheses:

Hypothesis 2: Technological strength has a significant influence on the choice of reverse innovation path of latecomer enterprises. Specifically, the stronger the technical strength of an enterprise, the more likely it is to choose a market-jumping path in the process of reverse innovation.

Hypothesis 3: The degree of technological innovation has a significant impact on the choice of reverse innovation paths for latecomers. Specifically, the higher the degree of exploratory technological innovation, the more likely it is for companies to choose a market-jumping path in the process of reverse innovation.

International entrepreneurship theory believes that the internationalization knowledge and experience possessed by entrepreneurs is one of the important factors that influence the choice of a company's internationalization path (Wang and Zhou, 2013; Zhang Xiu et al., 2017). Companies can obtain information and knowledge of consumer demand pain points in overseas target markets from their previous internationalization experience (Wu Junjie et al., 2014). Developed countries often have various barriers to market entry. In addition to explicit laws and regulations, technical standards, etc., there will be more hidden obstacles, such as government preferences, resistance from competitors in the same industry, and nationalism of local consumers. . Companies with extensive international experience can use their own experience or establish various communication channels with suppliers or customers to obtain the most direct local knowledge, insight into local market demand, product competition positioning, and choice of overseas market development paths Such important decisions are crucial. The internationalization experience of a company can not only reduce the uncertainty of international market operations, but also bring new overseas operation opportunities for companies (Pan Hongliang, 2019), such as entering new markets through intermediary relationships with existing customers. Generally speaking, companies with rich international experience have stronger risk tolerance and are more capable of directly launching new products in developed countries. For example, the high-end flagship phone of the Huawei P20 series is first released in the European market and then returned to the domestic market. Market to sell. Companies that lack internationalization experience generally tend to choose a more conservative approach to internationalization, that is, first release new products in the country, and when a certain market share and revenue are formed, they then adapt products according to the needs of target consumers in developed markets. Upgrade and improve the nature, and then import the products into developed countries' markets. Accordingly, we propose the following research hypotheses:

Hypothesis 4: Internationalization experience has a significant impact on the choice of reverse innovation paths for latecomer companies. Specifically, the more internationalization experience a company has, the more likely it is to choose a market-jumping path in the process of reverse innovation.

3. Research variables and data collection
(1) Dependent variable
The dependent variable of this article is the type of the reverse innovation path of the focus product. Based on the origins of creative sources, R&D, primary and secondary markets on the reverse innovation chain, we have identified 6 innovation paths (DDDA, ADDA, DDAD, ADAD, DDAA and ADAA, where A and D represent developed countries and Developing

countries). From the perspective of the first launch market and the secondary launch market of the new product (ie the combination of the last two links), these six implementation paths can be further summarized into two types, namely "gradual market" (market entry sequence starting from D) And "market jump type" (market entry sequence starting from A). This paper chooses these two types of reverse innovation paths of latecomer companies as dependent variables, with 0 representing the market gradual path, and 1 representing the market jumping path. The dependent variable is a dichotomous variable, so it will be analyzed by means of binary logistic regression.

(2) Explaining variables

Based on the theory of international entrepreneurship and the constituent elements of the reverse innovation chain of latecomer companies, we refine the key influencing factors contained in the processes of the innovation chain before market entry and use them as explanatory variables.

① The source of creativity, that is, the source of the concept of a new product. Creative sources can be divided into overseas ideas and local ideas. In the text, 0 represents entrepreneurial opportunities originating from overseas and 1 represents entrepreneurial opportunities originating from the local market.

② The technical strength of the enterprise is measured by the number of accumulated patents of the enterprise. The timing interval of the number of patents is the year from the establishment of the enterprise to the completion of reverse innovation of the focus product. The company's patent data are obtained from the soopat website.

③ The technological innovation level of the product is measured by the technological innovation strategy adopted during the research and development of the focus product. Based on the characteristics of the collected data, the technological innovation strategy is divided into two types: "excavation innovation" and "exploratory innovation". In the text, 0 is used for excavating technological innovation, and 1 is used for exploratory technological innovation.

④ The internationalization experience of the enterprise is measured by the age of the enterprise's internationalization operation, that is, the number of years the enterprise has been engaged in international operation when the focused product enters the target developed country market. For example, if the first internationalization of an enterprise occurred in 2000 and the internationalization of the focus product occurred in 2005, then the company's internationalization experience corresponding to the reverse innovation of the focus product would be 5 years.

(3) Control variables.

In the research samples, the internationalization years of each product are different, the time span involved in data collection is large, and there are many obstacles to retrospecting historical data. For variable values such as enterprise size, number of employees, industry environment, etc., they cannot be set as control variables because they are not feasible for data retrospection. From the perspective of data availability, this article finally selected the type of industry as the control variable in order to distinguish the industry characteristics of the various types of products involved in the sample. Through sorting, the industry type is finally divided into two industries, manufacturing industry and information communication technology, represented by "0" and "1" respectively.

(4) Data collection

According to the definition of reverse innovation in this study, 43 successful cases of reverse innovation products of latecomer enterprises were screened. Whether the case selection is appropriate will have a decisive influence on the analysis conclusion. In order to ensure the

quality of the case and the corresponding data, this article carried out the following quality control measures. First of all, it is ensured that the leading enterprises of the selected reverse innovation cases must be domestic enterprises in my country. These enterprises have already experienced the course of international development and at least one product has successfully entered the market of developed countries. Secondly, for each company, select its most representative international products as the focus products of the research to ensure that each focus product has been operated for a period of time in the developed countries market and has formed a stable market share in the local market. . Then, track the relevant materials and data of the initial design, R&D and internationalization process of each focus product to ensure that the R&D process of the focus product is carried out and completed in China to confirm that the innovation process meets the definition of reverse innovation. Finally, the reverse innovation product storyline must be complete and collectable, and the focus product and its company must be rich and accessible. This article mainly collects data through three channels: one is the primary data recorded during interviews with relevant technical personnel and management personnel of the enterprise; the other is reading books or video materials such as memoirs and interview records of enterprise managers; the third is from CNKI. Relevant enterprise cases retrieved from papers and academic conference literature databases; fourth is to collect internal publications from case companies through personal network resources; fifth is authoritative reports and detailed information disclosed on the company's official website, as well as mainstream media's true reports on corporate-related events, Meet the validity and completeness of data triangulation.

The basic information of the companies and their reverse innovation products involved in the sample is shown in Table 1.

Table 1: Sample description

the company	product name	years	the company	product name	years
Haier	Double door refrigerator	1991	Huawei	"Distributed" base station	2006
Haier	Little prodigy washing machine	1997	Huawei	P20 series mobile phones (high-end flagship phones)	2018
Haier	Mike Freezer	2001	Huawei	Fourth-generation base station (Single RAN)	2008
Haier	Ultra-thin large refrigerator	-	Huawei	USB Modem E220 (data card)	2006
Haier	Computer desk refrigerator	2003	Galanz	"Black King Kong" series microwave oven	2000
Haier	Red wine shelf	2003	Galanz	Lightwave oven	2001
Haier	Dual power washing machine	2002	TCL Group	Verone laptop	2016
Haier	25 minutes sports washing machine	2008	Dalian Yi Shi up	Cement Kiln Pure Low Temperature Waste Heat Power Generation Technology	2008
Haier	French door refrigerator	2007	MCC Jiaonai	Large top loading coke oven	2007
Haier	Magnetic levitation central air conditioner	2013	Wuhan Polytechnic	New energy membrane electrode	2015
Haier	Self-cleaning air	2016	SAIC Maxus	D90, T60	2017

	conditioner				
Haier	F series easy to install self- cleaning air conditioner	2017	HSUPA	USB Modem E270	2007
New ocean	Zhidou electric car	2013	Nanjing Fengtai	10G SDH Optical Network Products	2001
Nano	Monodisperse (homogeneous) silica gel chromatography packing	2016	Dajiang	Drone	2013
Shanghai Panye	Hydrogen energy battery	2009	Good boy	"Mom shakes" "Dad shakes" the stroller	1996
China South Locomotive	AC drive diesel locomotive	2010	Haikang	Weishi camera	2011
China High Speed Rail	High- speed rail technology	2010	Shakespeare Di	new energy vehicles	2003
Mindray	"Mini" black and white ultrasound equipment	2006	Wanxing Technology	PDF Converter	2005
Zhenhua Port Machinery	"Hercules" crane	2006	Wanxing Technology	dr.fone	2011
Goldwind Technology	Direct drive wind turbine	2009	Wanxing Technology	Video Converter Ultimate	2007
Shenzhen Netac	USB flash drive	2002	Wanxing Technology	PDFelement	2015
Sunward Intelligent	Small hydraulic excavator	2006			

4. Regression results

The logistic regression results are shown in Table 2.

Table 2: Logistic regression results

	B	SE,	Wals	df	Sig.	Exp (B)
constant	-1.044	.919	1.292	1	.256	.352
source of creativity	-2.753	.997	7.627	1	.006	.064
Enterprise technical strength	.000 077	.000 039	3.969	1	.046	1.000
The degree of technological innovation of the product	1.854	.933	3.947	1	.007	6.386
Corporate internationalization experience	-.022	.058	.141	1	.708	.979
Industry Type	0.12	.544	.436	1	.542	.677

Table 3: Accuracy results

Observed		Predicted		
		Reverse innovation implementation path		Percentage correction
		0	1	
Reverse innovation implementation path	0	28	3	90.3
	1	4	10	71.4
Percent of total				84.4

The regression results in Table 2 and Table 3 show that the explanatory variables that have a significant impact on the dependent variable are entrepreneurial opportunities, corporate technical strength, and product technological innovation, while international experience has no significant impact on the choice of corporate reverse innovation paths. The regression results show:

(1) The source of creativity has a significant negative impact on the choice of the reverse innovation path of the focus product, and the regression coefficient is -2.753 ($p<0.05$). This means that when ideas originate from overseas markets, the reverse innovation of latecomer companies more adopts a market-leaping path, that is, the first market diffusion of new products directly in the country where the ideas originate; conversely, when the ideas originate from the domestic market, The reverse innovation of enterprises is more adopting a market-gradual approach, that is, the first market for new products will be the domestic market or other emerging markets with similar needs, and then try to enter developed countries after success. Therefore, Hypothesis 1 is supported by empirical data.

It should be pointed out that the ways to obtain overseas ideas have gradually become diversified. Among them, the establishment of partnerships (such as suppliers, channel alliances, etc.) or multinational subsidiaries (self-built factories or branches, mergers and acquisitions, etc.) in the target country , Entrusting local consulting companies to conduct special market surveys, reading overseas professional journals or browsing various media information, etc., are the most typical ways to obtain information. It is worth pointing out that today is the era of data explosion. The global dissemination of information is not only through multiple channels but also at a fast speed. The demand preferences or consumption pain points of end consumers or corporate customers can be collected through a variety of online media channels and with the help of big data. Analysis technology to identify potential business opportunities, this method is being used by more and more enterprises.

(2) The technological strength of the enterprise has a significant positive influence on the choice of the reverse innovation path of the focus product. The regression coefficient is 0.000077 (Exp(B) is 1.000) ($p<0.05$). Although the value of the regression coefficient is small (due to the sample Small reason), but the significance level is lower than 0.05. This means that the stronger the technological strength of the latecomer enterprise, the more inclined to choose the leap-type reverse innovation path. On the contrary, the weaker the technological strength of the enterprise, the more inclined the enterprise is to choose the progressive reverse innovation implementation path. Research hypothesis 2 is supported by empirical data.

(3) The degree of technological innovation of the product has a significant positive impact on the choice of the reverse innovation path of the focus product, and the regression coefficient is 1.854 ($p<0.05$). This shows that if a latecomer company adopts an exploratory technological innovation strategy, the focus product is more likely to adopt a jump-type reverse innovation implementation path; conversely, if the product adopts an exploitative technological innovation

strategy, then the focus product adopts progressive The possibility of the implementation path of type reverse innovation is higher. Therefore, research hypothesis 3 is supported by empirical data.

The technical strength accumulated by latecomer enterprises in the local operation process provides technical support for new product development. The performance design of the new product needs to match the technical strength of the enterprise. It can be the application of the enterprise's existing core technology, or it can be an affordable extension of the core technology. The important thing is that the product development strategy must be compatible with the subsequent entry and business model of the first market and secondary market. If the company's technical strength is strong, new products can have a high degree of innovation, or are derived from the "customized" development of potential market demand in developed countries, the company often has greater confidence to open up the developed market in the first time. In order to choose a jumping path to finally realize technological innovation. However, if the company's technological strength cannot support the R&D of sufficiently differentiated new products, then as a conservative market operation strategy, the company chooses to put new products into emerging country markets at a relatively low cost to test market response. The adoption will have a greater possibility.

(4) The experience of enterprise internationalization has no significant influence on the choice of reverse innovation path of latecomer enterprises (p=0.078>0.05). Research hypothesis 4 is not supported. Existing research shows that companies with rich internationalization experience often have more overseas relationship capital, and can obtain local knowledge learning opportunities by establishing various communication channels with overseas suppliers or customers. This is important for companies to explore overseas markets and specific Operational strategies have important implications. The internationalization experience of enterprises not only helps to reduce the uncertainty of international market operations, but also provides optimized decisions for enterprises to enter overseas markets. However, the analysis results of the sample data in this article show that the internationalization experience does not have a significant impact on the choice of reverse innovation path of latecomer companies. The impact is too low.

5. Conclusion

In this paper, the path selection of reverse innovation of later-developing enterprises is the research object. From the perspective of reverse innovation chain, this paper studies the influence of creative sources, product technological innovation degree, enterprise technical strength and enterprise internationalization experience on the selection of reverse innovation path of late-comer enterprises. The study found:

First, if the creativity of reverse innovative products directly originates from developed countries' markets, companies are more inclined to choose a jump-type reverse innovation path, that is, to directly launch innovative products in developed countries' markets; on the contrary, if the product ideas originate from emerging countries Companies tend to adopt a gradual reverse innovation path, that is, to use the local market or other emerging country markets as the primary market for new products. After a successful transition, they will choose the right time to import the products into the developed markets.

Second, the stronger the technological strength of an enterprise, the more inclined it is to choose the leap-type reverse innovation path. Conversely, the weaker the technological strength of the enterprise, the more it tends to choose the incremental reverse innovation path. Technical strength is not only embodied in R&D and design capabilities, but also a deeper and more systematic organizational innovation capability and innovation support capability. It ensures that the company has a steady stream of technological innovation capabilities and strong capabilities by providing continuous support for technological learning and timely response.

The ability to tolerate trial and error enhances the ability of enterprises to quickly adapt and dynamically adjust to technological uncertainties in new markets, and enhance their confidence in successfully entering the markets of developed countries, thereby strengthening the jump-type entry path.

Third, for new products based on exploratory technological innovation strategies, companies are more inclined to adopt jump-type reverse innovation implementation paths. Conversely, if the technological development of new products is excavating innovation, then companies are more likely to adopt incremental reverse innovation. path. This means that the degree of technological innovation of new products corresponds to technological novelty and technological confidence, which has a significant impact on the international diffusion path of technologies, and the increase in the degree of innovation can accelerate the transfer of new technologies to developed countries' markets.

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