

The Empirical Research on Independent Technology Innovation, Knowledge Transformation and Enterprise Growth

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Abstract: In order to reveal the incentive functions of independent technology innovation during the process of knowledge transformation, the structure equation modeling (SEM) is used in the paper. By the choice of research elements, research hypotheses, establishment of research model and model checking, the SEM can effectively reveal the correlation between independent technology innovation, knowledge transformation and enterprise growth of the technology venture enterprises in Guangdong Province. For illustration, 500 questionnaires are distributed, 374 questionnaires return, the returns ratio is 87%, which satisfy the requirement that the questionnaire returns-ratio is not lower than 20% in the data investigation. The empirical results show that model fitting work well, and the model has high convergence validity. The research conclusions provide a realistic theory reference for the implementation of independent technological innovation strategies and knowledge transformation strategies for the purpose of enterprise growth in Guangdong high-tech venture enterprises.

Key words: Independent technology innovation; Knowledge transformation; Enterprise growth; SEM.

1 Introduction

In the knowledge economy, knowledge management is the basic platform that can conduct a variety of technological innovation including independent technological innovations. American Peter Drucker pointed out that different from traditional assets such as talent, capital and land, knowledge was the only meaningful manufacturing resource, and research on knowledge capital was deepening and expanding research resource of human capital in the new economy system (Ladd, Mark, 2002). School and Heisig made a series of research on the research status of

European knowledge management and companies that were good at knowledge management. The results showed that either theory scholars working on knowledge management, or enterprises engaged in knowledge management, held that knowledge transformation had been the most important problem in knowledge research (Wendi Bukowitz, 1998).

Tacit knowledge capital can be divided into two forms of tacit knowledge and explicit knowledge, where tacit knowledge is the main form of intellectual capital, and accounts for more than 80% of knowledge capital stock (Polanyi M, 1966). Knowledge transformation was converted from one kind of intellectual capital to another so as to be the key aspects of intellectual capital management. Japanese scholars Nonaka made the excellent contributions to knowledge transformation, which opened a broad space for knowledge management development. Nonaka and Takeuchi concluded that the success of Japanese companies came from the continuous knowledge transformation on the basis of a large number of Japanese companies. Knowledge transformation was divided into four basic modes including socialization, externalization, combination and internalization (Nonaka I, Toyama R, Konno N, 2000).

Therefore, independent technological innovation and knowledge transformation are two key motivation elements in the knowledge economy. The independent technological innovation and knowledge transformation promote the growth of high-tech venture firms, which shows the network-like incentive mechanisms. The resolution of this incentive path is to improve knowledge transformation strategies and enhance independent innovation capability in order to quickly promote business growth.

2 Research Model and Research Process

2.1 Research model and research process

2.1.1 The choice of knowledge transformation elements

Based on Nonaka's knowledge transformation theory, knowledge transformation elements can be divided into four indicators such as knowledge socialization, knowledge externalization, knowledge combination and knowledge internalization in high-tech venture enterprises.

Knowledge socialization refers to the conversion from tacit knowledge to tacit knowledge. Knowledge externalization refers to the conversion from tacit knowledge to explicit knowledge. Knowledge combination refers to the conversion from explicit knowledge to explicit knowledge. Knowledge internalization refers to the conversion from explicit knowledge to tacit knowledge.

2.1.2 The selection of independent innovation elements

Independent technological innovation is a form of technological innovation, so that the elements choice of independent technological innovation can learn from research results of technological innovation system. The domestic scholars generally conduct the decomposition of implementing technology innovation capability from the perspective of technological innovation process. A decomposition approach holds that such five elements as innovation decision-making capability, R&D capability, production capacity, marketing capability and organizational capacity constitute technical innovation capability (Zhang Tongjian, Kong Sheng, Li Xun, 2009). Another decomposition approach holds that the technical innovation capability is the enterprise-related comprehensive capacities including the decision-making ability, ability to obtain technology, engineering capability, production capacity, marketing capability and other

elements (Deng Jian, Zhang Tongjian, 2010). The technological innovation capability is classified as innovation decision-making capacity, R&D capability, engineering capability, manufacturing capacity, marketing capability, organizational coordination and resource allocation capability by National Science and Technology Commission.

Based on the operational characteristics of enterprises, independent technology innovation system can be divided into three elements such as independent R&D innovation, market innovation and independent management innovation. The independent R&D innovation refers to the improvement of product R&D capability, the independent market innovation refers to the improvement of marketing capability and the self-management innovation refers to the improvement of management capability.

2.2 The research hypotheses

2.2.1 Path analysis of knowledge socialization to independent innovation

In the process of the knowledge socialization, R&D personnel achieve innovative thinking by mutual information exchange or produce the inspiration on the basis of old experience. Marketers understand marketing strategies for competitors through a variety of information exchange, or create new marketing ideas through reflection. Similarly, managers can absorb other advanced management ideas so as to chew into their management practices among management activities or learn the essence of thoughts through imitation each other. It can be seen that there existed the knowledge socialization in the process of the independent technical innovation of venture enterprises everywhere. Thus, according to the above analysis, the following hypotheses can be given.

H1A: Knowledge socialization can promote the independent R&D innovation capacity.

H1B: Knowledge socialization can promote the independent market innovation capacity.

H1C: Knowledge socialization can promote the independent management innovation capacity.

2.2.2 The path analysis of knowledge externalization to independent technological innovation

In the process of knowledge externalization, the excellent technical staffs, marketing staffs and a variety of professional management personnel can report their own skills, ideas and methods. The experience, feelings and ways of thinking have been achieved standardization and shareable characteristic by the outstanding staffs, which can improve capital reserves normative in order to improve the efficiency of knowledge combination and knowledge internalization. R&D personnel, marketing personnel and professional management staffs can strengthen own operational capacity in the process of knowledge externalization. Thus, the following hypotheses are given.

H2A: Knowledge externalization can promote the independent R&D innovation capacity.

H2B: Knowledge externalization can promote the independent market innovation capacity.

H2C: Knowledge externalization can promote the independent management innovation capacity.

2.2.3 The path analysis of knowledge combination to independent technological innovation

In the process of knowledge combination, ideas, programs, plans and rules can exchange between different departments, so that the department-related development direction is more clearly. Personal's verbal information can exchange to enrich individual's experiences and strengthen individual's rules so that individual behavior and organizational behavior become more consistent. In companies, seminars, clubs and fairs are the typical knowledge socialization,

which can simultaneously improve their technological development platform, marketing planning platform and a variety of functional management platform. Thus, according to the above analysis, the following hypotheses are given.

H3A: Knowledge combination can promote the independent R&D innovation capacity.

H3B: Knowledge combination can promote the independent market innovation capacity.

H3C: Knowledge combination can promote the independent management innovation capacity.

2.2.4 The path analysis of knowledge internalization to independent technological innovation

In the process of knowledge internalization, product R&D personnel can observe the samples for inspiration, and improve their innovation skills through new knowledge learning. At the same time, marketers can quickly improve their ability to adapt to the market via a variety of training, or the marketing backbone experience can directly be passed on to their marketing field. In a variety of professional management markets, out learning can quickly improve their professional skills, learning and summarization of existing experience can significantly enhance their own professional quality. Thus, according to the above analysis, the following hypotheses are given.

H4A: Knowledge internalization can promote the independent R&D innovation capacity.

H4B: Knowledge internalization can promote the independent market innovation capacity.

H4C: Knowledge internalization can promote the independent management innovation capacity.

2.2.5 The path analysis of independent technology innovation to enterprise growth

The rapid growth of enterprises is a fundamental development goal. Owing to the restrictions of financial, personnel, technology and other elements, enterprises must take the road of independent innovation in order to maximize their technological advantages, market advantages or financial advantages to attain the rapid development of enterprises. The following hypotheses are given.

H5A: The independent R&D innovation can effectively promote enterprises growth.

H5B: The independent market innovation can effectively promote enterprises growth.

H5C: The independent management innovation can effectively promote enterprises growth.

2.3 Establishment of research model

On the basis of enterprises growth goals in Guangdong technology venture enterprises, the research model can be seen in Figure 1 through the rational choice of research elements and the summary of research hypotheses.

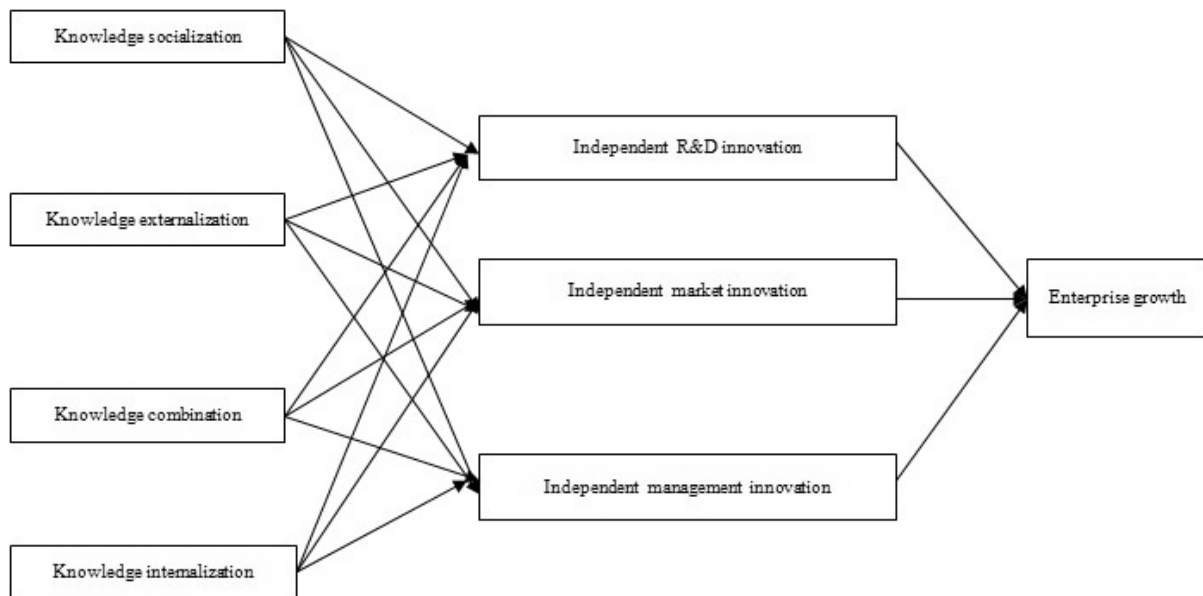


Figure 1 Research Model

3 Empirical Research

3.1 Factor decomposition

3.1.1 Elements decomposition of knowledge transformation

According to the literature (Lin Zhaowen, Zhang Tongjian, 2008), the elements of knowledge transfer system can be resolved based on the operational characteristics of technology venture enterprises in Guangdong Province. Elements of knowledge socialization can be decomposed into four indicators, such as the mutual learning and a relaxed-harmonious working atmosphere, a long-term communication, imparting experience and skills. Elements of knowledge externalization can be decomposed into four indicators, such as employees' conducting the summary of the skills and experience, extension mechanism in the company's organizational structure, formatting on skills and experience of organization members as well as promotion and encouragement of outstanding employees. Elements of knowledge combination can be decomposed into four indicators, such as the application efficiency, a database with the strong performance, the accumulation as well as the relevant information and data collection. Elements of knowledge internalization can be decomposed into four indicators, such as the improvement of workers' skills, the construction of enterprise culture, the incentives to the internal business reorganization as well as strengthening the learning organization.

3.1.2 Element decomposition of independent technological innovation

According to the literature (Prahalad, C. K. and Hamel, G, 1990), element decomposition of independent technology innovation system can be given. Independent R&D innovation can be divided into four indicators, such as professional quality, the effectiveness of incentive mechanisms, team cooperation as well as technology absorptive capacity. Independent market innovation can be divided into four indicators, such as marketing planning, market information

analysis, product-related market status, as well as financial operation mechanism. Independent management innovation can be divided into four indicators, such as risk prediction, the optimization of financing mechanisms, organizational structure upgrading as well as entrepreneurship.

3.1.3 Decomposition of enterprise growth elements

Growth elements can be divided into four indicators in high-tech venture enterprises. Firstly, the market value of core products is increasingly significant. Secondly, the social impact of core products is increasingly widespread. Thirdly, the market demand of core products is increasing. Fourthly, production environment of core products is improved.

3.2 Data collection

7 point scale system was accepted for data collection on the basis of 32 indicators. Sample units were the high-tech venture enterprises in Guangdong Province, which was related to the pharmaceutical, microelectronics, environmental protection and other industry types. Sample selection principle was that enterprises operation was in two to four years in order to fully reflect the enterprises' dynamic development. 500 questionnaires were distributed, 374 questionnaires returned, the returns ratio was 87%, which satisfied the requirement that the questionnaire returns-ratio was not lower than 20% in the data investigation. In the returned questionnaires, 192 data samples with higher quality were selected, so that the ratio of samples and indexes was 6:1 in order to meet the basic requirements of SEM validation.

3.3 Model checking

SEM was used to test the above research hypotheses. Based on variable analysis of covariance matrix, SEM was one kind of statistical method and a mathematical model to analyze the complex relationship of latent variables. Based on the obtained sample data, SPSS11.5 and LISREL8.7 were used to conduct the whole model checking, effect matrix of exogenous variables on endogenous variables (r) as well as effect matrix of endogenous variables on endogenous variables (β) were shown in Table 1.

Table 1 Effect Matrix

Assumption	First factor	Tail factor	Load factor	se	T value
H1A	Knowledge socialization	Independent R&D innovation	0.36	0.11	3.37
H1B	Knowledge socialization	Independent market innovation	0.38	0.13	2.95
H1C	Knowledge socialization	Independent management innovation	0.45	0.10	4.50
H2A	Knowledge externalization	Independent R&D innovation	0.23	0.09	2.56
H2B	Knowledge externalization	Independent market innovation	0.14	0.08	1.75
H2C	Knowledge externalization	Independent management innovation	0.18	0.07	2.61
H3A	Knowledge combination	Independent R&D innovation	0.31	0.14	2.39
H3B	Knowledge combination	Independent management innovation	0.17	0.12	1.43
H3C	Knowledge combination	Independent management innovation	0.13	0.08	1.52
H4A	Knowledge internalization	Independent R&D innovation	0.30	0.07	4.17
H4B	Knowledge internalization	Independent market innovation	0.41	0.13	3.18
H4C	Knowledge internalization	Independent management innovation	0.28	0.10	2.81
H5A	Independent R&D innovation	Enterprise growth	0.73	0.19	2.87
H5B	Independent market innovation	Enterprise growth	0.26	0.15	1.86
H5C	Independent management innovation	Enterprise growth	0.54	0.12	4.51

Model fitting index list was shown in Table 2.

Table 2 Fitting Index List

Fitting index	df	CHI-Square	RMSEA	NNFI	CFI
Index current value	417	629	0.079	0.963	0.950
Optimum value tendency	—	Smaller is better	<0.08	>0.9	>0.9

Therefore, model fitting worked well, and had high convergence validity without the need for revision, so other relevant verification results were omitted.

4 Conclusion

According to test results, knowledge socialization significantly improve enterprise-related independent R&D innovation, independent market innovation and independent self-management innovation in the growth process of the technology venture enterprises in Guangdong Province. Meanwhile, independent management innovation and independent R&D management innovation have a significant incentive to the growth of venture firms in the technology venture enterprises of Guangdong Province, but independent market innovation does not show the substantial incentive function to the growth of venture firms.

In the growth process of the technology venture enterprises in Guangdong Province, knowledge transformation improve enterprises' independent innovation capability to a certain extent, and thus indirectly promote the growth of venture enterprises. However, there is still large development room for the incentive mechanism to be further improved. First, based on the perspective of knowledge transformation, the function of knowledge socialization, knowledge externalization and knowledge internalization have been strengthened to a greater degree, while the function of knowledge combination is weak. Therefore, in the cultivation process of independent technological innovation, knowledge transformation behavior involved in tacit knowledge has been taken into account, and the transformation of explicit knowledge has been neglected, so that the dominant function of explicit knowledge capital has not been fully expressed. Second, based on the perspective of independent technological innovation, independent R&D capacity of high-tech venture enterprises has been effectively nurtured, and independent management innovation capability has been cultivated to a certain degree, but the cultivation effect of independent market innovation capacity is the worst. Finally, independent R&D capacity and independent management innovation have undergone substantial role, but the function of independent market innovation capacity is still in the state of lacking innovation.

High-tech venture enterprises are a special kind of enterprise, knowledge transformation and independent technological innovation are the catalyst for the growth of enterprises, but the occurrence of catalytic requires certain network path mechanism. The research conclusions provide a realistic theory reference for the implementation of knowledge transformation strategies and independent technological innovation strategies for the purpose of enterprise growth in Guangdong high-tech venture enterprises.

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