

Research on the Differences of Technological Innovation Capabilities of Private Enterprises

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ABSTRACT

Innovation is the fundamental driving force for enterprise growth. Based on field interviews and questionnaire surveys, this paper conducts an empirical study on the five different influencing factors of private enterprises' technological innovation capability, which are analyzed on diverse dimensions such as scales, property rights, growth stages, industrial maturity levels. Research shows that PI and IFE are the two most important influencing factors at current stage. Secondly, diverse scale enterprises have significant differences in PI and TTR. Thirdly, private enterprises with diverse growth stages have significant differences in TPI and TTR, too. Finally, IFE and IPP have significantly different impacts on enterprises located diverse industrial maturity.

Keywords: *Technological innovation, differences, influencing factors, survey*

1. INTRODUCTION

In the past 40 years of reform and opening up, especially in the past 15 years, Zhejiang economy has entered a new stage under the guidance of the 'eight-eighth strategy'[1]. More and more enterprises have realized that innovation is the fundamental driving force for enterprise growth. Growth is also gradually shifting from an extension of 'quantity' to an endogenous 'quality'. However, facing innovation difficulties such as lack of innovative talents, weak synergy ability have become obstacles factors that restricted private enterprises' innovation and development[2]. Based on field interviews and questionnaire surveys, this paper conducts an empirical study on the influencing factors of private enterprises' technological innovation capability, which are analyzed on different dimensions such as scales, property rights, growth stages, industrial maturity levels, with a view to provide guidance for enterprises to cultivate their own technological innovation capability.

2. DATA SOURCES

The paper selected private enterprises coming from Haining Leather Cluster, Cixi Home Appliances Cluster and Liuzhou Low-voltage Electrical Appliances Cluster as samples. Three industrial clusters are quite difference in development history, growth stage and organizational status, and they are good representatives in Zhejiang private enterprises[3]. A total of 860 questionnaires were distributed, 423 of which were valid. And 12 companies were field visited.

3. INFLUENCING FACTORS OF TECHNOLOGICAL INNOVATION CAPABILITY

In the questionnaire using the Likert Scale and positive evaluation, 24 structural problems affecting the technological innovation capability of private enterprises were designed. The 423 samples were analyzed using SPSS software. Common factors extracting by PCA were rotated with increasing variance method. Finally, five factors including 22 measurements¹ were extracted after eliminating one measurement quantity's factor load less than 0.5. The

¹ PI contains 7 measurements, which are product modification, improving product quality, shortening product life cycle, widening sales channels, increasing investment in technological innovation, strengthen the training of technicians, improving the technical content of products. TPI contains 5 measurements, which are understanding market changes through the Internet, revamping process with the help of MIS, improving content efficiency with professional software, facilitate internal collaboration through network, strengthen contact with customers and suppliers. IFE contains 4 measurements, which are establishment of professional financial institutions, making financing guarantee policy, abolish unfair financing policy, creating a fair financing environment. TTR contains 3 measurements, which are recruitment of professional and technical talents, maintaining the stability of technicians, encouraging core technicians. IPP contains 3 measurements, which are government Increases R&D Investment, making innovation incentive policy, making the policy of attracting talents.

five factors are product innovation(PI),process innovation(TPI), institutional financing environment(IFE), technological talent resources(TTR)and innovation promotion policies (IPP). The The common factors' total variance interpretation rate reached 72.08%.The original scores of the specific measurement quantities contained in each factor were summed up, then the mean value analysis and paired sample t-test were performed(Table 1). From the comparison of each influencing factor's mean value, we can find that IFE is the worst and PI is the best. At the same time, we also find that all factor's standard deviations are very small, the largest of which is only about 0.9. This shows that the respondents' judgments on each factor are not much different. The t-test dates in Table 2 clearly show that there are no significant difference among the mean values of other factors except for mean value difference between PI and TTR (0.0371). Therefore, we can sequence the influencing factors of private enterprises' technological innovation capabilities: PI, TTR > IPP >PI > IFE.

4.ANALYSIS OF THE FACTORS' DIFFERENCES

In order to further analyzing whether there are significant differences among the five influencing factors in diverse classification variables, that is scale, property rights, growth stages and maturity, it is necessary that t-test and one-way ANOVA on the differences of the factors' mean values were conducted.

4.1.Analysis of Diverse Scales

Taking 300 people as the demarcation point between small enterprises and large and medium-sized enterprises, the independent samples' t-test on the mean values differences of technological innovation capability of diverse scales' enterprises were carried out. From the analysis results (Table 2), we can find that there are significant differences between

small and large and medium-sized enterprises in PI and TTR. Moreover, small enterprises have better performance than large and medium-sized enterprises. The possible reason is that small enterprises often adopt niche strategy, in the fierce market competition, which relies on the acquisition convenience of information & knowledge within clusters and the imitation innovations at a lower cost achieving by a few technological talents. However, large and medium-sized enterprises mostly adopt primitive technological innovations, which requires a lot of financial and human resources. In fact, lots of primitive technological innovations are in an awkward situation due to serious shortage of resources input and difficulties in talent acquisition. There are no significant differences among in TPR, IFE and IPP to small enterprises and large and medium-sized enterprises.

4.2. Analysis of Diverse Property Rights

In this survey, the enterprises' property rights are generally divided into company system (including limited liability and joint stock company) and non-company system (including partnership, privately owned and individual businesses). From the results of t-test , it can be found that, except IPP, there are significant differences in factors between the corporate and non-corporate enterprises. Moreover, non-corporate enterprises have higher evaluations than corporate enterprises on factors' influences, among which IFE is the most evident factor. That is to say, the urgency of non-corporate enterprises in PI, TPI, TTR and IFE is less than corporate enterprises'. The possible reason is that they usually adopt a gradual innovation mode[4], such as technological imitation or simple improvement, in which the demand for talents is not high and the acquisition of talent resources is easy to meet, because the non-corporate enterprises in the sample enterprises are generally small in scale[5], weak in technical competence and no have enough financial resources to support innovation activities.

Table 1 Statistical analysis of the five factors

Factors' name	Standard deviation	Mean value	T-test			
PI	0.689	3.921				
TPI	0.795	3.567	0.3546***			
IFE	0.859	3.271	0.6501***	0.2955***		
TTR	0.765	3.884	0.0371**	-0.3176***	-0.6131***	
IPP	0.731	3.662	0.2590***	-0.0956*	-0.3912***	0.2219***

Notes:* p<0.05; ** p<0.01; *** p<0.001.

Table 2 T-test on diverse scales' enterprises

Factors' name	Small enterprises	Large and medium-sized enterprises	T-value	Sig. (2-tailed)
PI	4.066	3.779	4.375	0.000
TPI	3.554	3.579	-0.321	0.748
IFE	3.253	3.289	-0.431	0.666
TTR	4.035	3.735	4.110	0.000
IPP	3.686	3.639	0.658	0.511

Notes: The numbers of small enterprises and large and medium-sized enterprises are 210 and 213 respectively.

4.3. Analysis of Diverse Growth Stages

One-way ANOVA is needed in order to further testing whether there are differences among diverse growth stages' enterprises.

From the analysis results of Table 3, it can be found that there are significant differences among diverse growth stages' enterprises in TPI and TTR, of which the performance in the development stage and takeoff stage is the best. After having got through the start-up and seed stages, the enterprises have accumulated the resources and knowledge needed for further growth. In order to achieve a new round of rapid expansion, enterprises began to attract a large number of high-quality professional and technical personnel. While actively doing a good job in PI, TPI has also become a new direction for technological innovation. There are no significant differences among diverse growth stages' enterprises in PI, IFE and IPP.

However, changes in influencing factors of private enterprises' technological during enterprises growth stages could not be clearly show in Table 4. Therefore, the performances of factors are sequenced. In general, Zhejiang private enterprises did the best in PI and TTR, while the

worst were IFE and TPI, IPP was in the middle state. This shows that private enterprises have generally recognized the importance of PI for the survival and development of enterprises. TTR are the basis of the PI smooth running. However, the main reasons of the current TTR shortage are congenitally deficient TTR and unformed effective maintenance mechanism. Poor financing channels and insufficient funds are still an important factor restricting the formation and cultivation of private enterprises' technological innovation ability. Zhejiang enterprises are mostly a labor-intensive processing and manufacturing enterprises, therefore sufficient funds and personnel are the basic guarantee for the formation of technological innovation capability. Most private enterprises' dependence on local government technology innovation promotion policies has been weakened, on the other hand, they have gradually established the consciousness that enterprises are the main body of technological innovation. At the same time, the technological process innovation capability of private enterprises is generally weak, which is also a new direction for Zhejiang private enterprises to expand their technological innovation space.

Table 3 One-way ANOVA on diverse growth stages' enterprises

Factors' name	Start-up	Survival	Development	Takeoff	Maturity	F-value	Sig. (2-tailed)
PI	4.017	3.862	4.025	3.884	3.854	1.249	0.290
TPI	3.302	3.585	3.862	3.838	3.447	6.883	0.000
IFE	3.151	3.261	3.584	3.197	3.365	2.376	0.510
TTR	4.100	3.658	4.164	4.051	3.713	9.367	0.000
IPP	3.565	3.705	3.796	3.649	3.593	1.111	0.351

Notes: The number of sample enterprises in each stage is 106, 173, 48, 57 and 39, respectively.

Table 4 One-way ANOVA on diverse industrial maturity levels

Factors' name	Leather	Home Appliances	Low Voltage Appliances	F-value	Sig. (2-tailed)
PI	4.038	3.889	3.852	2.744	0.065
TPI	3.567	3.650	3.475	1.797	0.167
IFE	3.503	3.265	3.069	8.892	0.000
TTR	3.984	3.861	3.820	1.673	0.189
IPP	3.696	3.750	3.536	3.386	0.035

Notes: The number of sample enterprises in each level is 126、156 和 141, respectively.

4.4. Analysis of Diverse Industrial Maturity Levels

The three cluster industries of Haining Leather, Cixi Household Appliances and Liuzhou Low-voltage Electrical Appliances are in different stages of industrial evolution. There are differences among enterprises located diverse industrial maturity (Table 4). There are significant differences in IFE and IPP, and industrial restructuring is significantly higher than the stage of entrepreneurial transformation. Because private enterprises in the restructuring stage face industrial rapid changes and reshuffle, they frequently need to raise funds with the help of various financing channels, rapidly expand enterprises scale, and establish own dominant position. At the same time, enterprises have also placed high expectations on local government technology innovation promotion policies in a turbulent environment.

5. CONCLUSIONS

From the above analysis, we can draw some conclusions and provide useful enlightenment for technological innovation mode of private enterprises and government policy optimization.

TPI&IFE are the two most important factors at this stage. Financing support insufficiency has become a resistance to project innovation and technological transformation of private enterprises, and then further restricted enterprises intension expansion. Most enterprises' understanding of technological innovation is still limited to product innovation. TPI has not been paid enough attention by private enterprises, especially organization optimization and production process optimization. Therefore, government ought to give priority in improvement of financing environment and enhancement of enterprises themselves' technological process innovation in the future. There are significant differences between small and medium-sized enterprises in PI and TTR, and small enterprises have higher evaluation than large and medium-

sized enterprises. In addition to IPP, non-corporate enterprises have better performance than corporate enterprises in influencing factors of technological innovation ability. This shows that many large and medium-sized private enterprises are in a dilemma of technological innovation. We should combine the market driven foreign aid technology innovation with the technology driven endogenous technology innovation, at the same time make full use of the advantages of cluster economy to jointly promote the cluster technology innovation of private enterprises.

Private enterprises in different growth stages have significant differences in the performance of technological process innovation and technological talent resources, and they perform best in the development stage and take-off stage. IFE&IPP are significantly different among enterprises with different industrial maturity, and the stage of industrial restructuring is significantly higher than the stage of transformation and innovation. Therefore, private enterprises need to gradually shift their innovation focus to technological process innovation for the second undertaking and the new round of rapid development.

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