Innovation Capacity and Development Potential of Haidian District

CHENG Xiaoyue ZHAO Yanyun XIE Yihui
Centre for Applied Statistics, Renmin University of China, 100872, Beijing

Abstract

Enterprise innovation capacity analysis has been always the hotspot of the economists. This paper is based on the innovation survey of enterprises in Haidian District which is the precursor of congregating innovative industries and companies, in Beijing City, even China. Via the analysis on the enterprise innovation input-output, the policy and finance supports of the government, and the general and industry evaluation of the development potential, we find some interesting trends of enterprise innovation in this region.

Keyword: enterprise innovation; survey; input-output analysis; policy support; finance support; industry evaluation.

1. Introduction

Haidian District is a pioneer of today's technique innovation in China, and an important reference for the government considering new technique stratagem. Haidian is the biggest accumulation zone for the scientific research, education, innovative and high technology industry. 68 universities and colleges lie in Haidian, including the famous Peking University, Tsinghua University, and Renmin University. There are also 231 scientific institutions in Haidian, and the number of academicians working in Haidian is around 36% of all. About 378 thousand research specialist staffs are having their jobs in Haidian, and more than 4000 overseas students come back to Haidian for their venture dreams.

Thanks to the ample human and intellectuality resource, Haidian has become the most suitable investment destination for the innovative and high technology investors all over the world. The Silicon Valley of China--Zhongguancun Science and Technology Park lies in the center zone of Haidian District. The abundant research resources and achievements bring forth to a new firm pattern, which gives priority to the research specialist staffs and exploited technology, and commixes the technology, manufacture, and commerce. More than 10,000 high-tech enterprises are located in the park, in which 40 firms create over 100 million RMB of gross industrial output value. The industrial pattern of Haidian is high-tech-motivated, the primary and service industry-assisted. Basing on the statistic, more than 80% of Beijing's high and new technology enterprises lie in Zhongguancun Science and Technology Park.

This paper is focusing on a systematic research upon the innovation capacity and

development potential of Haidian District. The data that our research based on is so rare that hardly can other research institutions get. The data set amalgamates the enterprise innovation survey and enterprise annual financial and technique reports. Thus it would be helpful when we analyze the innovative activities and processes of manufacturing and service firms.

2. Frontier of the Enterprise Innovation Analysis

The innovation theory was established long ago. But different from the classical innovation, the modern regional innovation is based on the creation of knowledge, and plays important role in the economy growth of a country or a region. Generally speaking, any country or region cannot remain invincible or takes on high ground in the international competitiveness unless it has the strong innovative capacity. In the microcosmic view, innovation can strength firms' capacity of absorbing and utilizing the knowledge.

2.1 Innovation theory

The international theory circle has spent long time researching on innovation. The word INNOVATION was first used by Joseph Schumpeter, the famous American Austrian economist, in his The Theory of Economy Development published in 1912. The one and only test criterion of innovation he inferred is the ensuing monopolistic super profits.

Developing in the following nearly one hundred years, the theory of innovation experienced the theories of classical technological innovation and linear model, and got the breakthrough in the new century. First of all, the concept of innovation has been re-defined. Two points are emphasized on the basis of Schumpeter's definition: the value realization and the notion extension of innovation. Second, new models of innovation theory emerge. After B.A. Lundvall touched on the concept of national innovative system for the first time, the international society began to study innovation in the view of system theory. After the recent twenty years' empirical study, innovative system method, knowledge fluid theory, and dynamic nonlinear alternative innovation pattern are gradually accepted by the international society, and made as the theoretical directory when the countries make new innovation stratagem.

2.2 Types of enterprise innovation

Enterprises are the main participants of innovative activity. Making researches on enterprise innovation theory under the direction of the above theories is our final destination. Theoretically, enterprise innovation consists of technological innovation and non-tech innovation. Specifically speaking, technological innovation includes Product Innovation and Process Innovation; while non-tech innovation contains Business Model Innovation, Management Innovation, Organizational Innovation, Cultural Innovation, Institutional Innovation, and so on.

Technological innovation is an outcome from market economy. It represents for the economical technological activities relative to the R&D, manufacture and commercialization of the new techniques (including new products and new processes). In short, technological innovation is the first commercial application of new techniques. There are three significant features of technological innovation. First, the market realization extent and the achieved

commercial profits are the ultimate criterion of judging the success of innovation. Second, the process from new-tech R&D to the first commercial application is a systematical project. Third, enterprise is the main body of technological innovation. In the course of economy growth, technological innovation has an outstanding status. The science technology must turn from the knowledge form to the substance form, from the latent productivity to the practical productivity, if it is going to be the primary power to push the rise of economy. Besides, the transformation realizes in the tache of technological innovation. Therefore, technological innovation is the kernel of economy progress.

Contrast to technological innovation, non-tech innovation lacks paradigm; and the content it contains are wide. It can be said that all of the innovative activities in the management, except technological innovation, are non-tech innovation. Non-tech innovation has the traits of sensitivity, variety, path-depending, learning, non- replicated. It is possible in the future that non-tech innovation will play a role no less than technological innovation in the process of improving the international competitiveness for Chinese enterprises.

2.3 Literature summary

The observation and the factor exploration of industry innovation and regional innovation capacity have been always the hotspots of the economists. The former research tried to summarize the factors having influence on enterprise innovation to a universal theoretical frame. The representative ones are as follow: Dorfman and Steiner (1954) designed a simple but intuitionistic model to explain the determinatives of R&D expends. Scherer(1965) published his technological opportunity factor inspiring theory. Griliches(1957), Schmookler(1966), Scherer(1982) emphasized the influence from demanding aspect-- the market size, etc. The subsequent researches also came down to the enterprise size, cash flow, and diversification extent. Some scholars such as Cohen and Klepper(1992) thought the factors mentioned above cannot explain the difference of innovative activities between enterprises, thus it is possible that the difference depends on a stochastic process relative to the innovation but exceeding the technological capacity of enterprises.

Chinese academicians have made several practical researches from microcosmic data. An Tongliang compared the industry, size, and ownership of the enterprises and concluded that industry was the chief factor affecting on R&D. Zhang Jie and his colleagues further discussed the influence from firms' size, export, and agglomeration effects.

3. Innovation Power of Haidian

This research is based on the data from both industry enterprise innovation survey in Haidian and their corresponding financial data report. From the survey we finally get the data of 563 corporations, between which some have innovative activities while some not. The survey was made up of two questionnaires named Industrial Enterprise Innovation Questionnaire and Entrepreneur Questionnaire[1], and the financial data report consists of the basic situation of the firm's management and especially the factory's R&D activity.

[1] Both questionnaires are designed by National Bureau of Statistic of China and have the questionnaire codes: VII501&VII502.

Of those 563 enterprises, more than 4/5 have innovative activities. Of the total 99,546 employees in the 638 enterprises, 34.5%, that is 34,445 employees, graduate from universities or graduate schools. Innovative expenses in 2006 reached 5.37 billion RMB yuan, and in 2007 this index increased to 5.80 billion. New product value in 2006 was 59.10 billion yuan. And the patent maintenance expenses were 36.16 million yuan. The frequency of patent application counted up to 1,855 in 2007, inside which there are 1,150 patented inventions. The patents owned by those investigated enterprises amounts to 5,235.

3.1 Enterprise innovation input

The enterprise innovation input reflects the innovation capacity to a certain extent. Figure 1 is the innovation expenses histogram of the 462 enterprises of the 563 that had innovative inputs. The left one is a original figure and there are two distinct outliers. The middle one and the right one is the histogram that have been deleted several outliers. It can be seen in the figure that the data is right-skew which means a few enterprises devoted large amount of innovation expenses. View on the innovation expense expending(Figure 2 and 3), we find that internal R&D is the uppermost expending approach. Although few enterprises had external R&D or external techniques, the expenses on them were high.

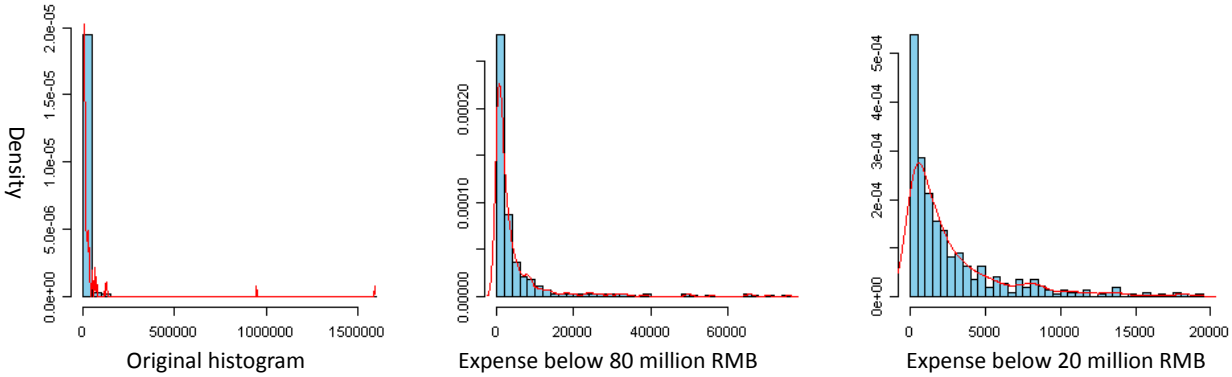


Figure 1 Histograms of enterprise innovation expenses(Unit: thousand yuan)

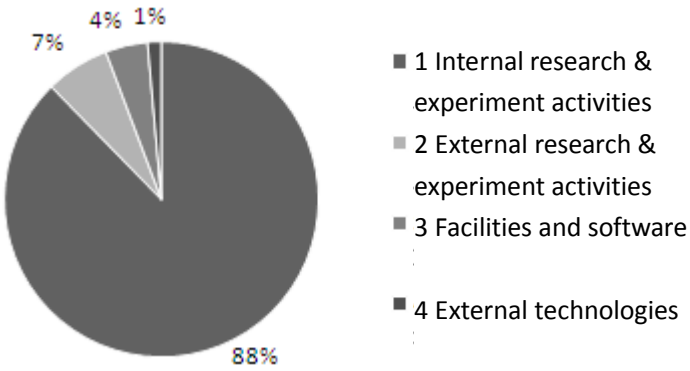
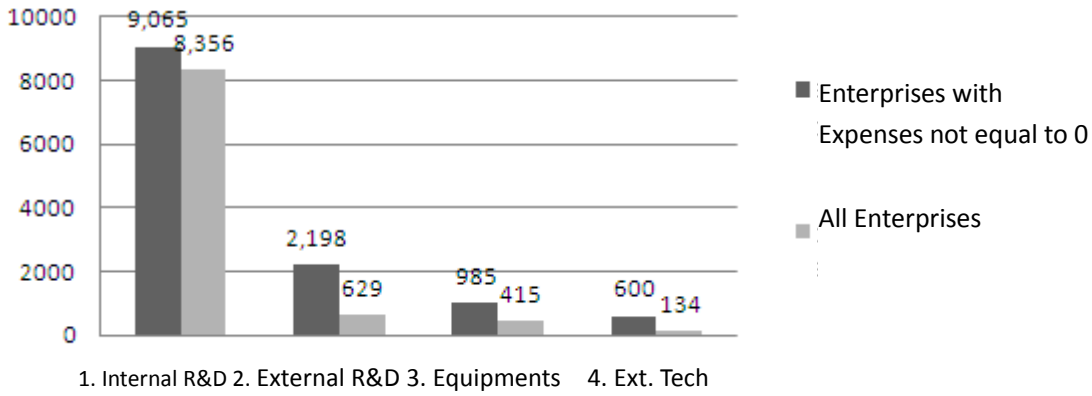


Figure 2 Pie chart of innovation expense purposes



1. Internal R&D	3. buying innovative equipments & software
2. External R&D	4. getting relative external technology

Figure 3 Mean innovation expenses by purposes (Unit: thousand yuan)

3.2 Enterprise innovation output

3.2.1 New product

Output of new product is an important index to measure the effect of enterprise innovation. The average output of new product of the 563 firms in 2006 was 0.104 billion RMB yuan and if we delete the 135 firms which did not have output of new product, the average would increase to 0.138 billion yuan. From Figure 4 and 5 we can also see that the median of this index is much lower than the mean.

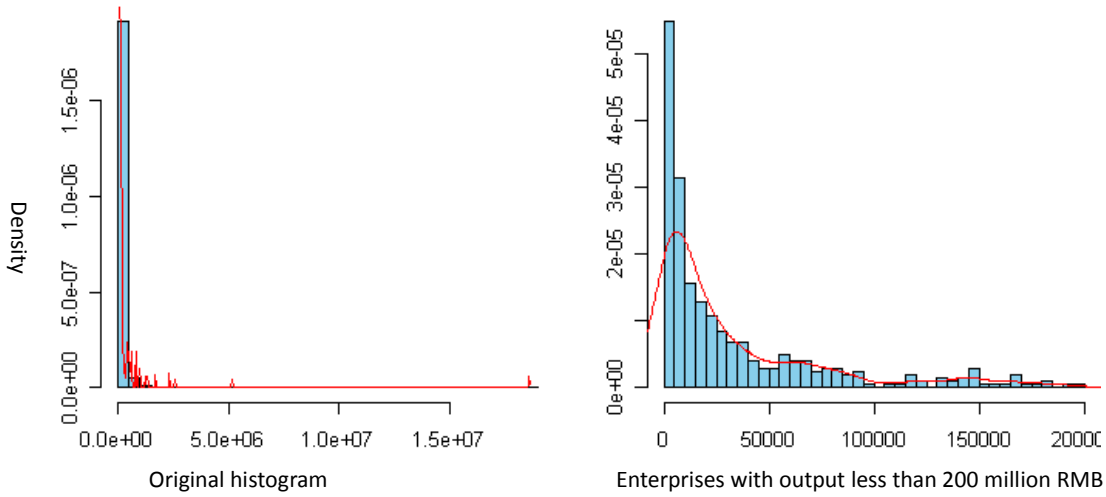


Figure 4 Histograms of output of new product (Unit: thousand yuan)

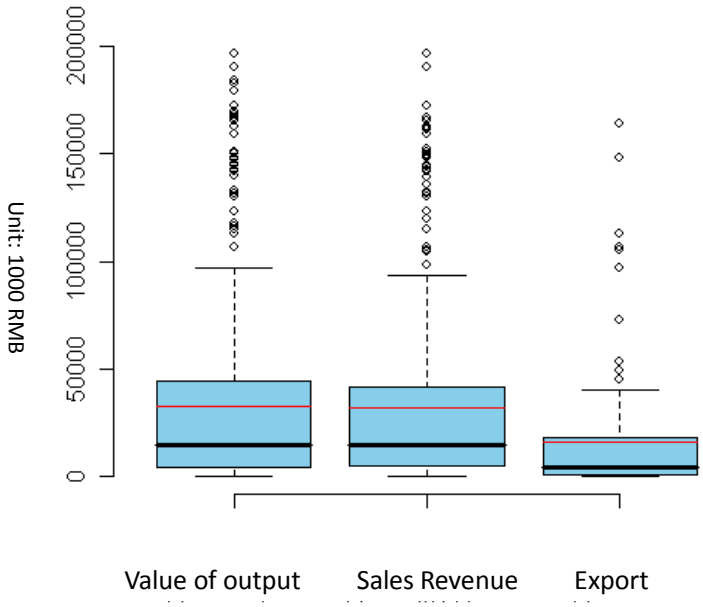


Figure 5 Box plots of the innovation outputs

Although the amount of output of new product is enormous, from the novelty analysis we find that international new product only took up 6% while the domestic new product was of 22%. It is thus clear that the superiority in quantity may not bring the same advantage in quality.

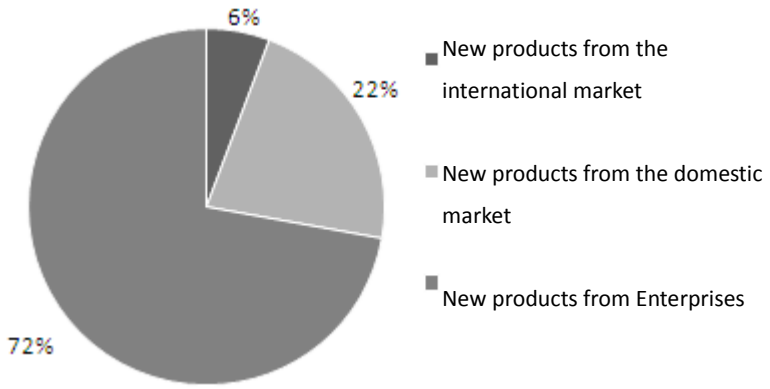


Figure 6 Market value share of different novelty products

From the further clustering analysis we find that, for the external-depending enterprises, more expenditure on buying external techniques brings out more revenue from enterprise new products than international and domestic new products. For internal-depending type, internal R&D makes more contribution to domestic new products than international new products. For the efficient type, internal R&D contributes to enterprise new products, while getting innovative equipments and software brings benefit to both enterprise and domestic new products. For the high-end product type, the success on international new products benefits from the internal R&D more than external; but the success on domestic new products seems to benefit from both. For the weak kind, although the general performance is not as good as other kinds, we see that its expenditure on internal R&D and buying equipments & software contributes to some revenue from international new products; and the expends on external

R&D brings some revenue from enterprise new products.

Summarizing the features mentioned above, we can make some conclusions: internal R&D is essential for innovation output, especially international and domestic new products; but if an industrial firm only depends on internal R&D, the comparatively input-output efficiency will fall down. The combination of internal and external R&D will improve the input-output efficiency. The combination of internal R&D and buying equipments & software will accelerate the high-tech innovative output, that is, revenues from international and domestic new products, without the loss of input-output efficiency.

3.2.2 Patent

Patent is the invention and creation protected by the Patent Law. It is authorized by the country and protected by the law in public. It is the first step by which manufactories turn knowledge into value. It is also one of the kernel factors that determine the enterprise innovation capacity. Many researchers at home and abroad are used to regard the number of patent as the index of measuring output of enterprise innovation.

Using the number of patent applications and the output of new product of the 563 firms in 2007, we make correlation tests and get the Pearson correlation is 0.730, Kendell and Spearman correlation are respectively 0.285 and 0.348, all of which are significant on the 0.01 level.

But from the survey we find that the firms that choose to apply patents or register trademarks only take up about one third, the firms that rely on other national legal instrument to protect their intellectual property rights are also no more than 30% (Figure 7). However, 3/4 of the firms prefer secret inside protection.

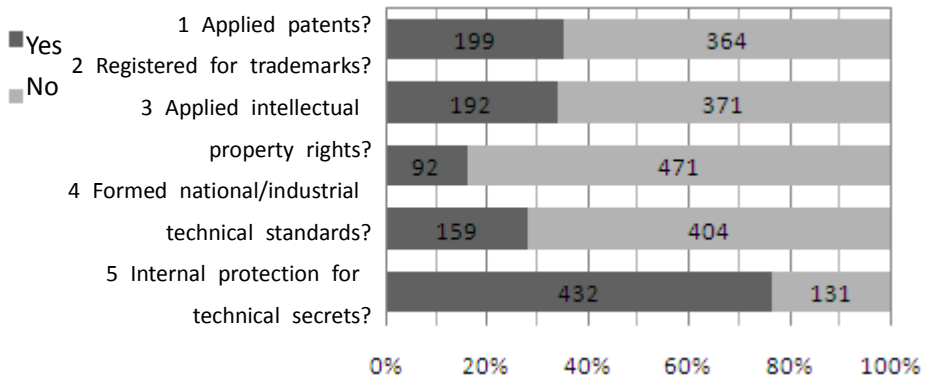


Figure 7 Patent protection methods of 563 enterprises

Figure 8 shows that although 563 firms totally applied 1855 patents, 435 of them did not apply. Only 128 firms applied in this index, 72% of which applied less than 7 patents.

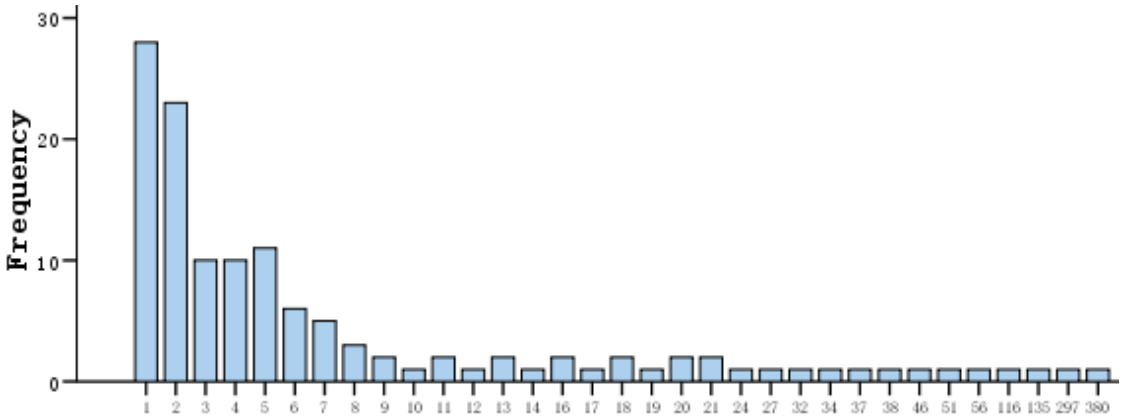


Figure 8 Frequency bar chart of 128 patent applying enterprises

3.2.3 Independent brand

Independent brands indicate those brand exploited by the enterprises themselves which own the independent intellectual property rights. This index can be used to measure three aspects: market possessing capacity, history of R&D, and the status in the whole industry. Independent brand is the middle step by which manufactories turn patent into new product value. Of the 563 firms, more than 30% did not have their own independent brand in 2006. Only 390 firms had.

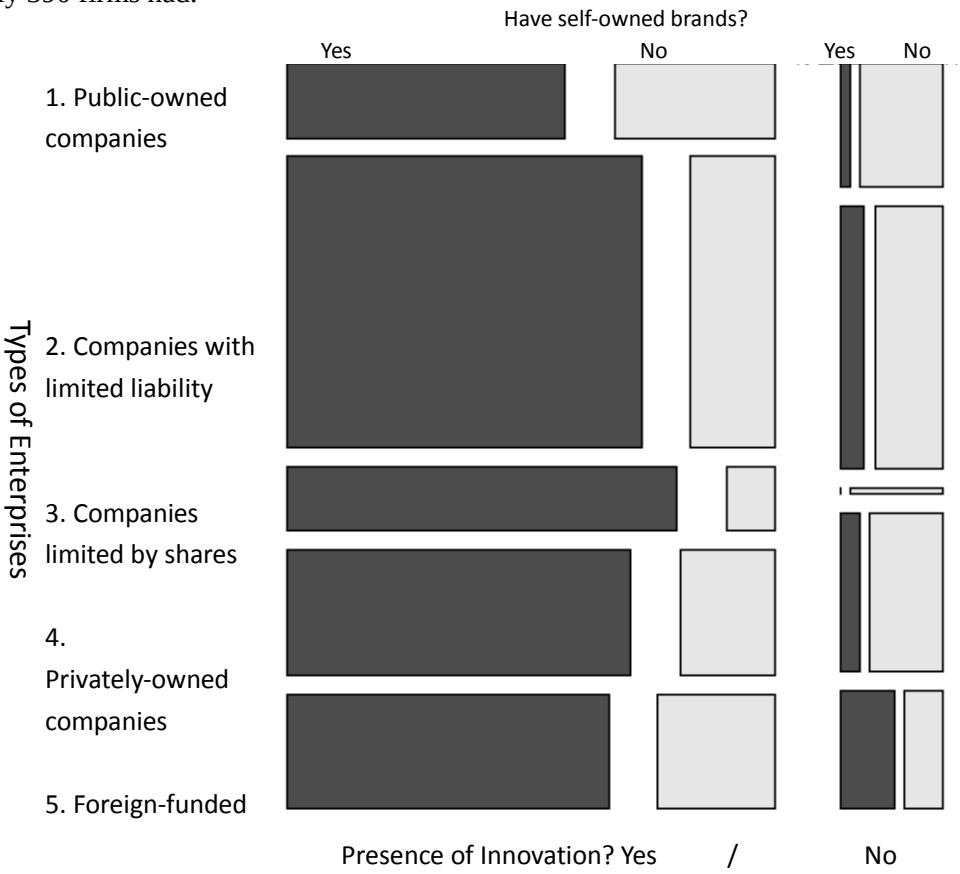


Figure 9 Mosaic plot of 563 enterprises

Figure 9 is the mosaic plot of the 563 enterprises categorized by ownership and whether independent brand. The abscissa “whether has innovative activity” is the first category floor.

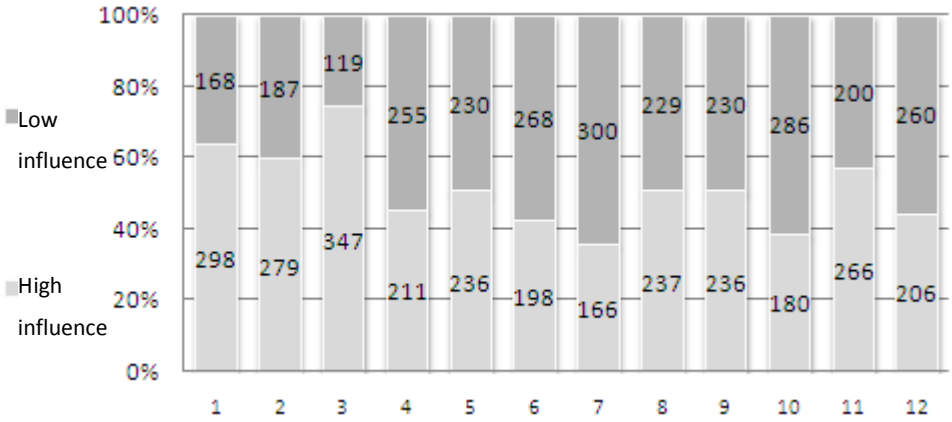
We find around 4/5 of the 563 firms had innovative activities in 2006. The ordinate "ownership" is the second category floor. It can be seen that both in innovative and non-innovative enterprises, limited liability companies take the biggest proportion. The third floor is categorized by "whether has independent brand". We can find that the highest proportion appears in the innovative incorporated corporation group; while the lowest appears in the non-innovative incorporated corporation group.

4. Policy & Finance Support of the Government

There are many support factors of enterprise innovation. This paper first analyzes in the aspects of policy and finance. We will discuss other subjects in the future if they can be supported by data.

4.1 Policy support

In the recent years, the government has continuously intensified the policy benefit for enterprise technological innovation. In 2006, Chinese government promulgated National Science and Technique Developing Programme for a Long Period (2006-2020), and pointed out that the state should recognize independent innovation as a national strategy on the purpose of improving the competitiveness of China. In 2007, government of Beijing City and Zhongguancun management committee executed variety of favorable policies to improve the regional innovation capacity. The policies includes at most 2.7 million bounty for those restructured and IPO enterprises; a series of favorable policies for those enterprises which were asserted by "Enterprise Technology Center"; preferential taxes for enterprises which account R&D expenses into costs; financial allowance for those which cooperate with Zhongguancun Open Laboratory; and so on.



1.Counting tech researching expense into costs
2.Deducting income tax by tech researching expense
3.Reducing income tax for high-tech enterprise
4.Quickening depreciation of R&D equipments
5. Being exempted from sales tax of technology transfer and exploiture
6.Finance support
7. Government procurement
8. Protecting the intellectual property
9. Industrial policy
10. Foreign economic policy
11.Encouraging to cultivate and attract specialists
12.allowing enterprise to take charge of the technology projects of government

Figure 10 Policy influence on enterprise innovation

How did the policies influence on the enterprise technological innovation? It can be reflected by the enterprises' judgment. The survey investigates the influence on enterprise innovation from 12 policies (Figure 10). We find that lightening tax burden is more favored by entrepreneurs than any other hortative policies. Counting the technique research expenditure into cost, canceling out more income taxes by the technique research expenditure, prompting the firms to cultivate and attract talented persons are several other popular policies. On contrast, the unnecessary and over elaborate formalities are the main reasons that limit the effect of those popular policies. Less attraction and unknown are the primary reason for those unpopular policies.

Figure 11 tells us the reason for which those enterprises think the policy lacking of effect. We can summarize the traits into three: first, the transaction procedures are too fussy for the popular policies. Second, less attraction or no information is the primary influential factors for the low-effect policies. Third, the "other reasons" should be paid attention to.

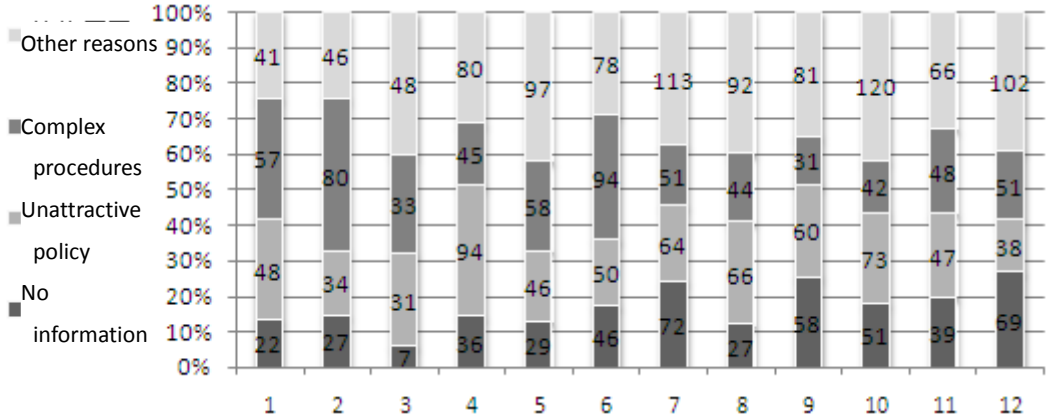


Figure 11 Reasons for the low influence of the policies

The government has been also augmenting the financial support year after year at the same time as the policy inclination. From our data set, the government fund for the innovation expenses increased from 0.291 billion in 2006 to 1.052 billion in 2007. The rate of increase reaches 362%. The rapid increase of the financial support completely embodies the determination that the government will definitely sustain the enterprise innovation.

However, we should also see that the number of enterprises in possession of the government fund has decreased from 76 in 2006 to 63 in 2007, which reflects a feature of fund convergence besides the increase. The causes perhaps contains that government heightened the threshold of subsidizing, or government tried to foster several key high-tech enterprises in a short time. The inclination should be noticed, as the medium and small-sized enterprises will perhaps loosen their innovation when they are improperly guided by government.

4.2 Finance support

The enterprise innovation in Haidian District has a tremendous lifting room for financial support. Since Haidian District is the biggest accumulation zone for the scientific research, and high technology industry, the latent huge profit room brought by the knowledge cannot be simply estimated, and it is the greenhouse for the financial innovation to the moment.

Financial innovation refers to the creation of new financial instruments, markets, and

institutions in the financial services industry; new ways for people to spend, save, and borrow funds; changes in the operation and scope of activity by financial intermediaries. Financial innovation is a developing process that is slowly but steadily pushed by profit stimulation. There are three lays in apprehending the definition of financial innovation: on the macro lay financial innovation equals to those weighty historical changes, the apprehension believes the history of finance is a innovative history; on the middle lay financial innovation refers to the changes of financial institutions especially the bank intermediary function after the 1950s; on the micro lay financial innovation is just the innovation of financial instruments.

From the present data, the index that can reflect the financial support is only “Loans from Financial Institutions”, one of the innovation expense sources. For the 563 enterprises, the amount of loans from financial institutions is 83.424 million yuan in 2006, 148 thousand yuan per firm. In 2007, the amount rocketed to 89.605 million yuan and 159 thousand per firm. Actually, the enterprises that can get the loan is mere, 22 firms in 2006 and 9 in 2007. The rate of drop is 59.1%. Besides, the number of enterprises that can get the loans for both years is only 4.

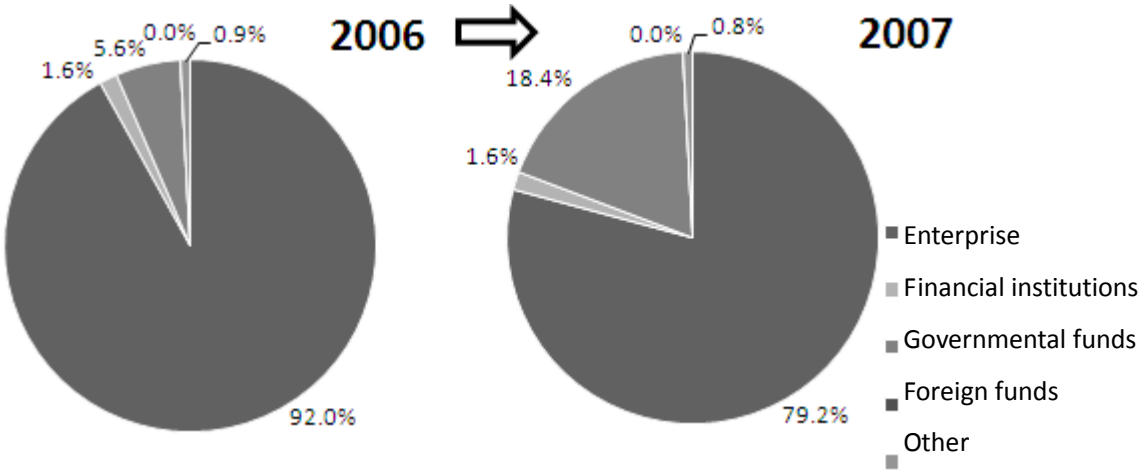


Figure 12　563 enterprises’ innovation expense sources in 2006-2007

Figure 12 indicates that the most support for industry enterprise innovation in Haidian is the enterprise funds, but the loans from financial institutions and government funds both increased in the year, although loans from financial institutions had not been more than 2%. This represents the conservative attitude of financial institution. As is known, innovation must be accompanied by a high risk of failure. How to measure this kind of innovation risk, the problem has not an example of solution in China. Financial institution should notice the opportunity of financial innovation.

5. Enterprise Innovation Potential Analysis

5.1 General evaluation

From 2005 to 2007, the innovative activities of 563 enterprises made an increasing trend in general. Looking into the original distributions of three years, we find all the distributions are right skew and several outliers exist. The average innovation expenses are respectively

6.680 million, 9.534 million, and 10.297 million RMB yuan of the three years; the median are 0.721 million, 1.103 million, and 1.207 million yuan.

Now let us focus on the innovation expenses changes in each interval to conclude the development potential of 563 enterprises, as is seen in Figure 13 (To weaken the influence from outliers, we make the natural logarithm transformation for the innovation expenses, and the unit of the data before transformation is thousand yuan.). The abscissa of the figure is the natural logarithm of innovation expenses and the ordinate is the number of enterprises in every interval. In the period of 2005 to 2007, the frequencies of expenses show a downward trend in the left intervals while an upward trend in the right intervals. This trend represents the distribution of innovation expenses is gradually moving to the right, which indicates the global input of innovative activities is hoisting.

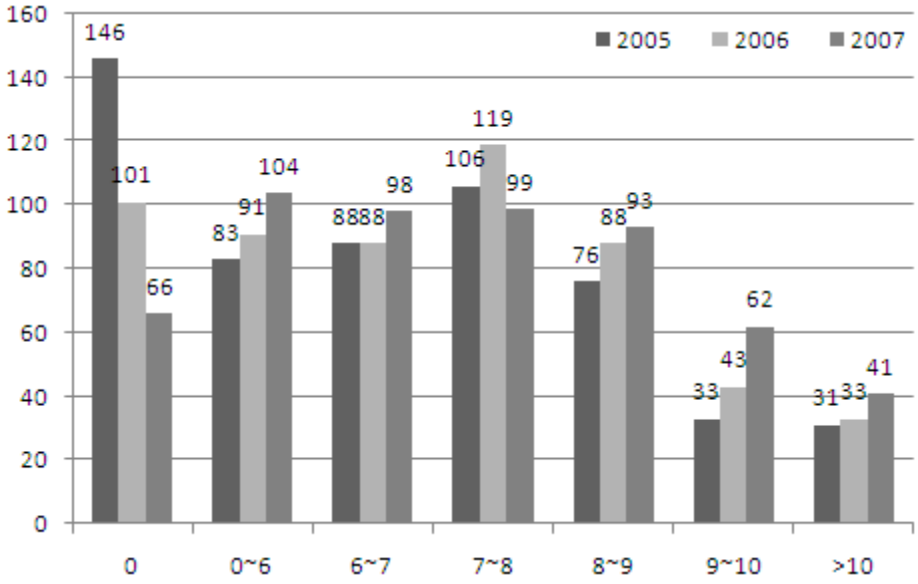


Figure 13 Frequence chart of the logarithm innovation expenses of three years by intervals

Via counting the increase rate of innovation expenses, we find that the innovation potential is unbalanced. Although most enterprises of the 563 kept strong developing potential, innovative activities in some enterprises is decreasing or fluctuating. Figure 14 shows this fluctuation: between 2005 and 2006, about 40% enterprises kept the increase of innovation expenses, but the increasing rates mostly converged to [0%, 100%] and the upper and lower quartiles are 42% and -8%. But between 2006 and 2007, although there are still about 40% enterprises in an upward trend, but the differences among the increasing rates are enlarged. The upper and lower quartiles of increasing rates are 109% and -26%. This reflects the unbalance of the dynamic change.

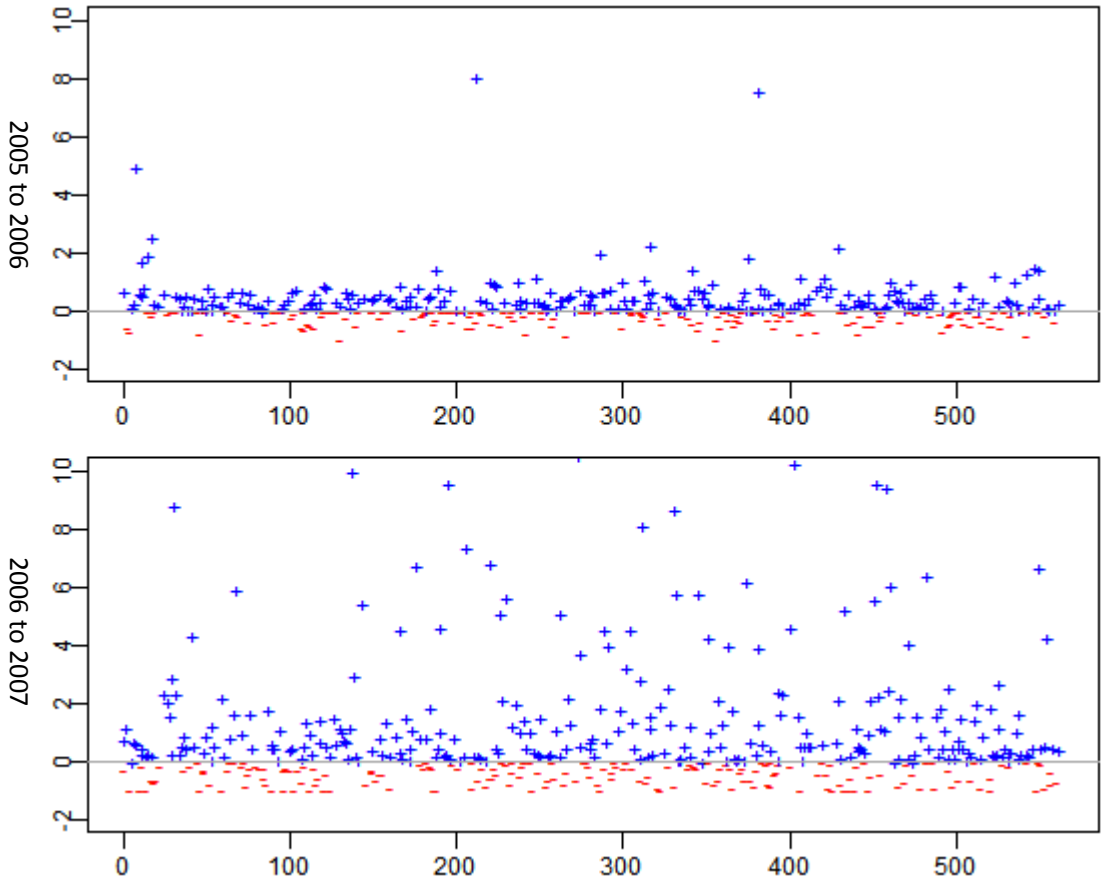


Figure 14 Increasing rate plots of 563 enterprises' innovation expenses

Generally speaking, the traits of enterprise innovation potential in Haidian are: first, the global level of innovative activities is hoisting and the innovation inputs are more and more. Second, most enterprises attach importance to innovative activities and about 45% enterprises are enhancing the input for innovation. Third, the enterprise innovation potential is unbalanced and this feature is intensifying.

5.2 Industry evaluation

The industry distribution of 563 enterprises spreads 34 main classes and 164 subdivisions. As Figure 15 shows, when divided by main classes, most enterprises are of the manufacture of telecommunications equipment, computers and other electrical machinery; manufacturing of instruments, meters, cultural and office machinery; manufacture of special equipment.

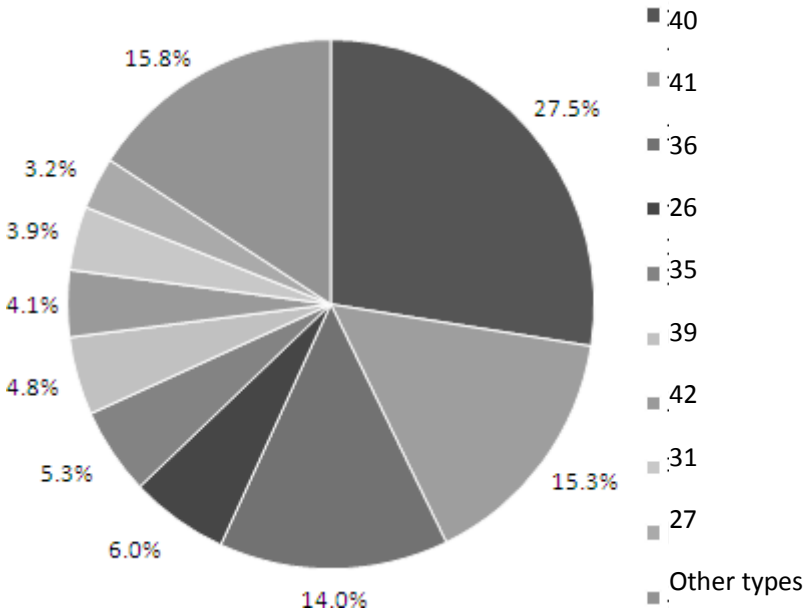


Figure 15 Industry distribution of 563 enterprises

Table 1 Industry Codes and Appellations

Code	Industry	Code	Industry
13	Processing of farm products	34	Manufacture of metals
14	Manufacture of food products	35	Manufacture of general equipment
15	Manufacture of beverages	36	Manufacture of special equipment
17	Manufacture of textiles	37	Manufacture of transport equipment
18	Manufacture of wearing apparel	39	Manufacture of electrical machinery and apparatus n.e.c.
23	Publishing, printing and reproduction of recorded media	40	Manufacture of telecommunications equipment, computers and other electrical machinery
25	Manufacture of coke, refined petroleum products and nuclear fuel	41	Manufacturing of instruments, meters, cultural and office machinery
26	Manufacture of chemicals and chemical products	42	Manufacture of artware and other products
27	Manufacture of medical products	61	Computer services
29	Manufacture of rubber products	62	Software industry
30	Manufacture of plastics products	63	Wholesale trade
31	Manufacture of non-metallic mineral products	75	Research and Experimental Development
32	Processing of black metals smelting and calendering	77	Science and technological exchange and popularity

Figure 16 shows the top 20 industries which had the largest median innovation expenses. Since the data is severely right skew, we use the median of the indicator as the statistic of measuring the average level, instead of the mean, which is unstable when there are outliers.

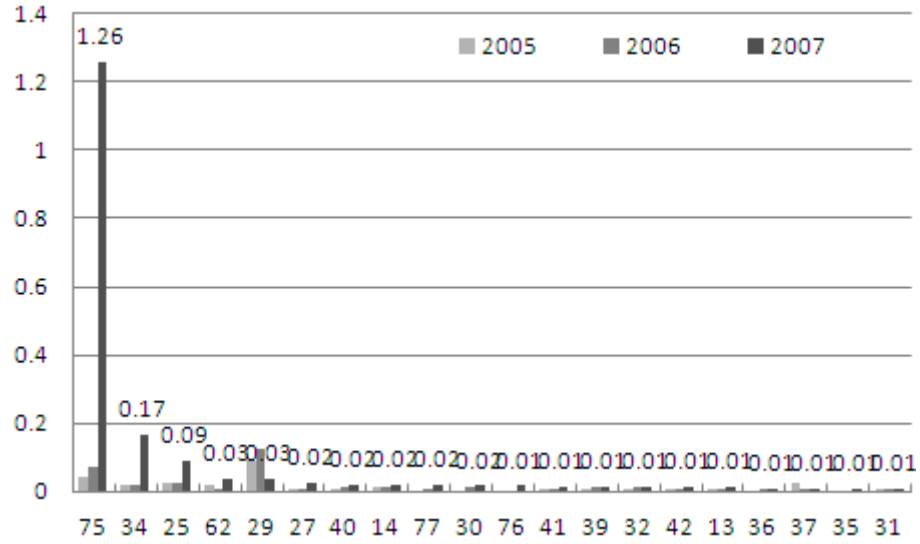


Figure 16 Top 20 industries which had the largest median innovation expenses in 2005-2007 (Unit: 100 million yuan)

From Figure 16 we can see that the top 5 industries of median innovation expenses in 2007 were Research and Experimental Development; manufacture of metals; manufacture of coke, refined petroleum products and nuclear fuel; software industry; manufacture of rubber products. The top 5 industries in 2006 were manufacture of rubber products; Research and Experimental Development; manufacture of beverages; manufacture of coke, refined petroleum products and nuclear fuel; manufacture of metals. The top 5 industries in 2005 were manufacture of rubber products; Research and Experimental Development; manufacture of beverages; manufacture of coke, refined petroleum products and nuclear fuel; manufacture of transport equipment. Generally speaking, the innovation expenses of different industries fluctuated in three years, but Research and Experimental Development; manufacture of rubber products; manufacture of coke, refined petroleum products and nuclear fuel; manufacture of metals always kept in a high level.

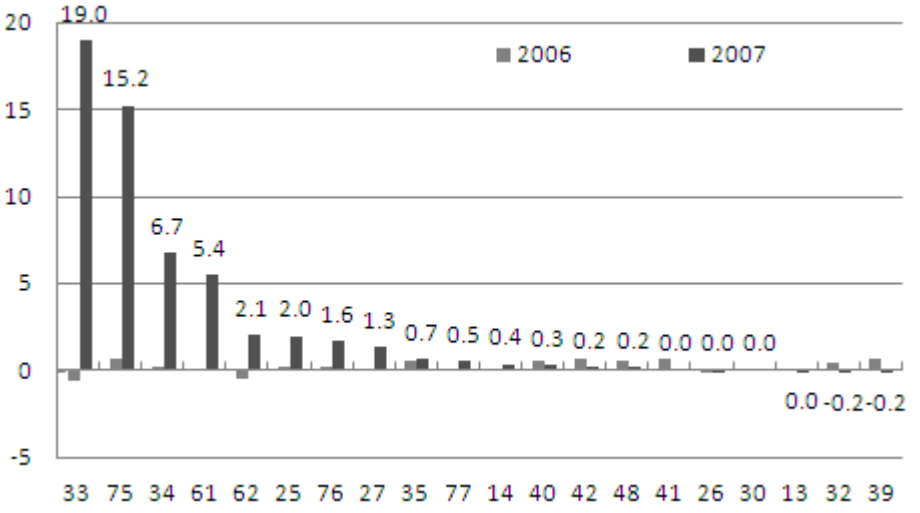


Figure 17 Increasing rates of innovation expenses in different industries in 2005-2007

Figure 17 displays the growth rates of innovation expenses in different industries in three years. Between 2006 and 2007, the growth rates of processing of black metals smelting & calendaring and Research & Experimental Development were more than 1000%. But more than 1/3 industries were decreasing. Between 2005 and 2006, only the increasing rate of manufacture of special equipment was more than 100%. The change of growth rates shows the variety of innovation inputs.

Figure 18 shows main industries' possession of independent brands in 2006. It can be found that the top 3 industries which had the largest amount of independent brands were manufacture of telecommunications equipment, computers and other electrical machinery; manufacturing of instruments, meters, cultural and office machinery; manufacture of special equipment. Undoubtedly, this result has correlation with the large amount of these industries' firm number. We can see that the top 3 industries which had the smallest amount of independent brands were also the three.

In terms of the proportion of independent brand, after deleting 17 industries that had less than 3 firms, the industry which had the highest proportion was manufacture of special equipment. Manufacture of food products; manufacture of metals; manufacture of non-metallic mineral products; processing of farm products; and wholesale trade were the next five industries.

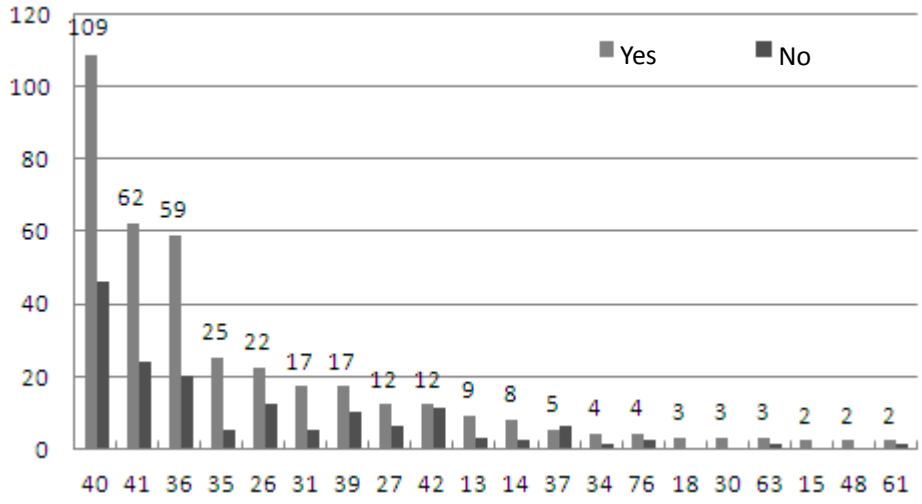


Figure 18 Main industries' possession of independent brands in 2006

Figure 19 shows the top 20 industries which had the highest median output of new product in 2006-2007. Apparently, the median output of new product of manufacture of coke, refined petroleum products and nuclear fuel was much higher than any other industries. And that of manufacture of metals was also significantly high. The next 3 industries were manufacture of medical products; manufacture of non-metallic mineral products; and processing of black metals smelting and calendaring.

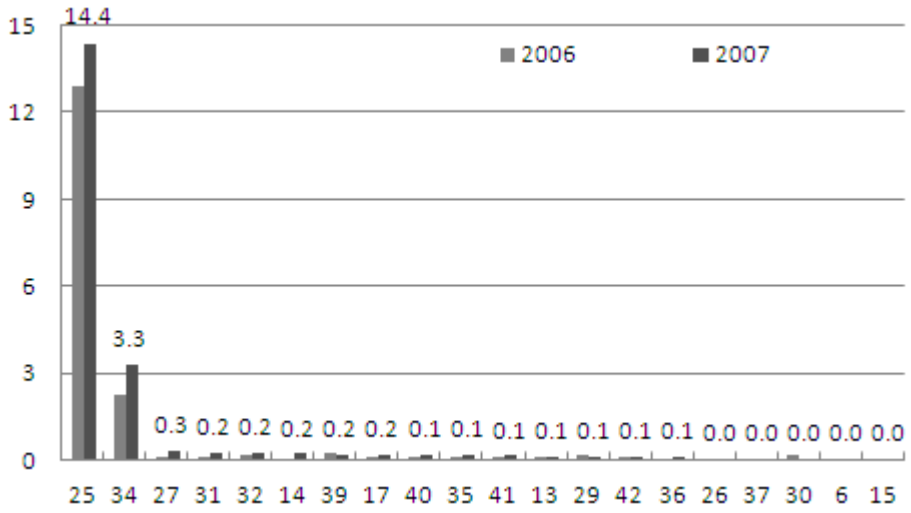


Figure 19　Top 20 industries which had the highest median output of new product in 2006-2007（Unit: 100 million yuan）

Similarly, we can watch the change of output of new product in terms of growth rate. Figure 20 displays the top 20 industries which had the highest increasing rate of median new product value between 2006 and 2007. In all of the 34 industries, there were half industries having a negative growth rate. Manufacture of food products; manufacture of medical products; and manufacture of non-metallic mineral products kept the highest increasing speed.

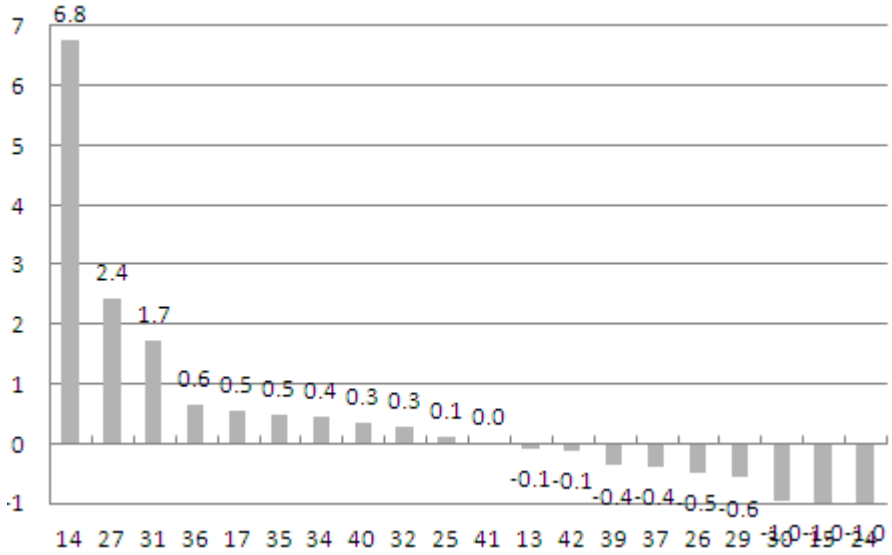


Figure 20　Top 20 industries which had the highest increasing rate of median new product value between 2006 and 2007

Figure 21 shows the patent application amount of different industries in 2007. The amount of manufacture of telecommunications equipment, computers and other electrical machinery was much larger than others, which represents the regard to patents of this industry. The following industries were manufacture of artware and other products; manufacture of general equipment; manufacture of special equipment; and manufacturing of instruments,

meters, cultural and office machinery.

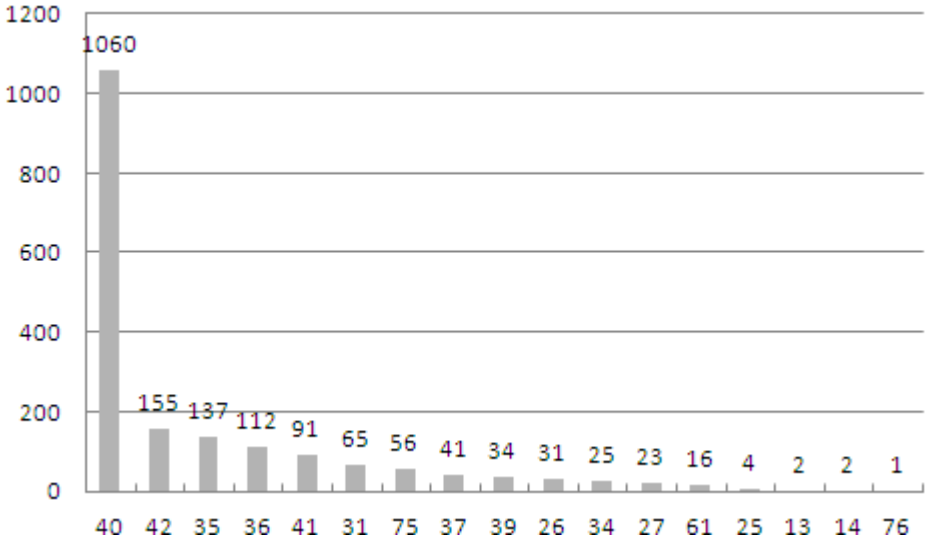


Figure 21 Patent application amount of different industries in 2007

Figure 22 and 23 respectively display the top 20 industries which had the most median assets and profits in 2007. Among the top 20 industries, manufacture of coke, refined petroleum products and nuclear fuel; manufacture of rubber products; and Research and Experimental Development were always in the first four places. The top 3 industries which had the highest return on assets (ROA) were building installation (24.9%); processing of black metals smelting and calendaring (24.8%); and manufacture of metals (13.4%). Manufacture of plastics products and software industry were the industries which had the lowest ROA, and their return rate were only -26.9% and -11.7%.

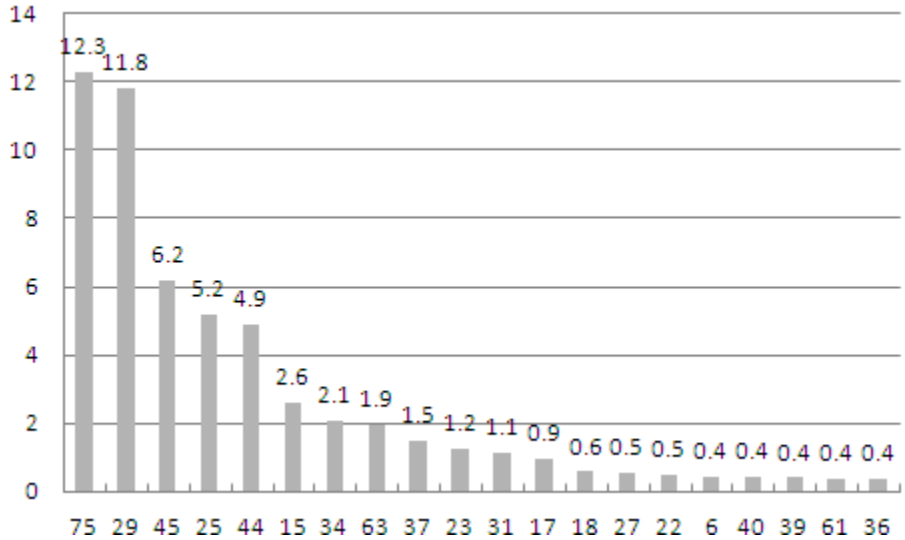


Figure 22 Top 20 industries which had the most median assets in 2007
（Unit: 100 million yuan）

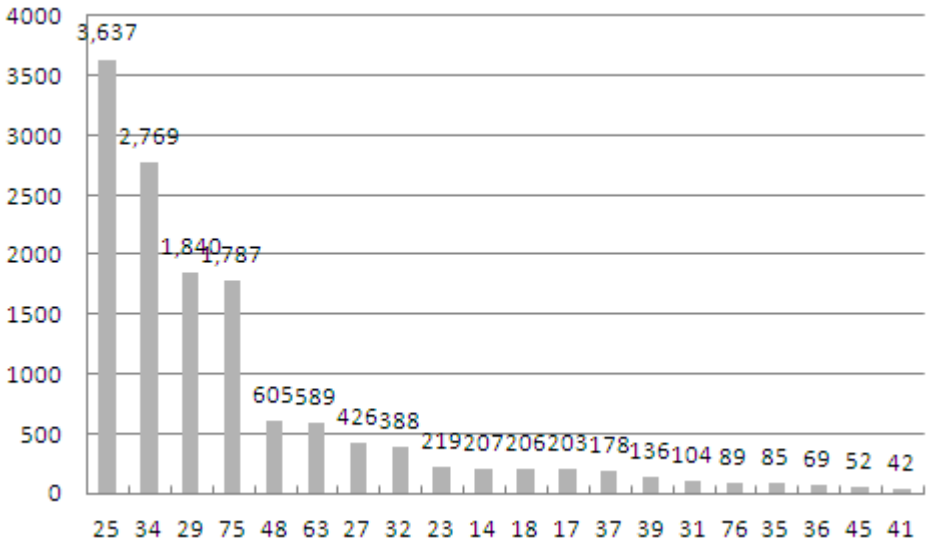


Figure 22　Top 20 industries which had the most median profits in 2007 （Unit: 10 thousand yuan）

Through the above analysis on the innovation inputs, outputs, increasing trend, and some basic situation, we can conclude some features of industry innovation development potential. First of all, manufacture of coke, refined petroleum products and nuclear fuel and manufacture of metals have advantage on the amount of both innovation inputs and outputs, and have high ROA. Their rapid growth in recent years is apparent. In the circumstance of the global energy shortage, we believe the innovation of energy processing has enough driving power and will keep the momentum of growth. Second, manufacture of telecommunications equipment, computers and other electrical machinery did not had much assets or profits in the comparison between different industries, but it owns much patents and independent brands. In terms of innovation input and growth rate, this industry was in upper course, and showing up the stable developing trend. Third, manufacture of food products and manufacture of medical products shape up in terms of innovation inputs and outputs of new product, as well as the growth rate. Besides, the two industries rank in the second and third places in the indicator ROA. Although the existing data cannot help to judge the causal relationship between innovation input & output and ROA, the two industries can be also cited as examples of positive relation, which should be paid attention to.

6. Conclusions

To summary, enterprises in Haidian district attach importance to innovation and have made great achievement. At least five conclusions could be made from the analysis: first of all, high concentration in several corporations indicates more companies only stay on a low innovative level. Second, proper combination of the four kinds of innovation inputs will improve the input-output efficiency and accelerate the high-end output. Third, the government gives some supports to enterprise innovation by policies and allowances, but it should be avoided that the threshold of support is heightened. Fourth, the financial institution did not give enough support to enterprise innovation, and the measure of innovation risk should be paid attention. Fifth, the global level of innovative activities is hoisting but the innovation

potential is unbalanced.

Our suggestions for the government include about six points. The first one is when making policies for promoting enterprise innovation, the most important thing that should be thought is whether the policy will bring real profit and convenience, if not, the policy is a waste. Second, after the policy is promulgated, the government should propagandize it as widely as possible and predigest its procedure as much as possible. Third, find an effectual way to give financial support to innovation enterprises and avoid the lift of supporting threshold. Fourth, strengthen the communication between innovation enterprises and financial institutions, in order to establish new methods of financial innovation. Fifth, build a bridge for cooperation between innovation enterprises and research institutions by some political methods. Six, lead the enterprises to a direction that can reduce the energy consumption and environmental pollution.

Suggestions for enterprises involve cultivating talented person, improving their own brands, promoting the innovation of high-end new products, enhancing the cooperation with other corporations and institutions, and increasing the input-output efficiency by suitably combining innovative activities, such as internal R&D and buying equipments & software, or internal and external R&D.

References

A. Jaffe. (1988) *Demand and Supply Influences in R&D Intensity and Productivity Growth.* [J] Review of Economics and Statistics, 70(3):431-437.

Gengshen Zhao, Qiaoling Lei. (2006) *Restrict Factors and Countermeasure Researches of Chinese Firms' Independent Innovation*. [J] Science & Technology Progress and Policy, (3):129-131.

George Casella, Roger L. Berger. (2002) *Statistical Inference.* [M] Wadsworth.

Haiyang Zhang.(2005) *Two Faces of R&D, Activity of FDI and the Growth of Productivity of Domestic Manufacturing in China*.[J] Economic Research Journal. 2005.5.

Hao Meng. (2006) *Analyzing on Innovation Diffusion in Cluster*. Conference paper.

Hengpeng Zhu.(2006) F*irm Size, Market Power, and the R&D Behavior of Non-governmental Enterprises*.[J]The Journal of World Economy. 2006.12.

J. Schmookler.(1966) *Invention and Economic Growth,*. Harvard University Press, 1966.

Jici Wang.(2004) *Developing Innovation-Based Industrial Clusters: Policy Recommendations.* [J] Economic Geography. Vol.24,(4).

Jie Zhang, Zhibiao Liu, Jianghuai Zheng.(2007) *Key Factor Research on Chinese Manufacturing Firms-- Based on a Survey of the Manufacturing Firms in Jiangsu Province*. [J] Management World. 2007.6.

Keming Yu, Zudi Lu, Julian Stander. (2003) *Quantile regression: applications and current research areas*. [J] The Statistician, 52, Part 3, pp. 331–350.

Lan Xue, Qunhong Shen, Shugui Wang.(2002) *R&D Investment Distribution in China of the International Firms under Global Stratagem*.[J] Management World. 2002.3.

Lin Chen. (2002) *Robust Regression and Outlier Detection with the ROBUSTREG Procedure*. [J] SUGI27, 265-27.

Philippe Aghion, Nicholas Bloom, Richard Blundell, Rachel Griffith, Peter Howitt. (2005)

Competition and Innovation: An Inverted U Relationship. [J] Quarterly Journal of Economics, 120(2): 701-728.

P. Gayle. (2003) *Market Concentration and Innovation: New Empirical Evidence on the Schumpeterian Hypothesis.* Working Paper.

P. Steiner, R. Dorfman.(1954) *Optimal advertising and optimal quality.* American Economic Review, 44(5):826–836, 1954.

Scherer.(1965) *Size of firm, oligopoly and research: a comment.* Canadian Journal of Economics and Political Science, 20(5):423–429, 1965.

Tongliang An, Hao Shi, Ludovico Alcorta.(2006) *An Observation and Empirical Study of R&D Behavior of Chinese Manufacturing Firms: Based on a Survey of the Manufacturing Firms in Jiangsu Province*.[J]Economic Research Journal. 2006.2.

Tongliang An, Wenyi Wang, Wei Wei.(2005) *Technique Innovation of Chinese Manufacturing Firms:Pattern, Power and Holdback -- Based on a Survey of the Manufacturing Firms in Jiangsu Province*.[J] Contemporary Finance & Economics. 2005.12.

Xiaoxuan Liu.(2000) *The Impact of the Structure of China s Industrial Enterprise s Ownership on Its Efficiency*.[J] Economic Research Journal. 2000.2.

Yang Yao, Qi Zhang.(2001) *An Analysis of Technological Efficiency of Chinese industrial firm*.[J] Economic Research Journal. 2001.10.

Yaolie Zhou, Daliang Zhang.(2001) *Technique Innovation Survey and Rule Analysis in Zhejiang Province*.[J]China Industry Economy. 2001.5.

Yufang Shen, Liping Guo.(2004) *Globalization Trend of R&D Activities of the Multinaional Companies and Strategies for China*.[J] Scientific Management Research. Vol. 22,(4).

Z. Griliches, Hybrid corn. (1957) *An exploration in the economics of technical change.* Econometrica, 25:501–502, 1957.