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## Statistical Analysis of Features of China's Enterprise Innovation Activity<sup>1</sup>

—Based on the 2017 data on Chinese Enterprise Innovation Survey

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**Abstract:** The Second National Enterprise Innovation Survey was conducted in China in 2017, targeting industry, construction and service sectors. This survey used to a large extent the Oslo Manual as reference in terms of norms and standards and drew on lessons and experiences from innovation survey practices in EU countries. However, there were additional contents to it, such as, survey of entrepreneurial groups. According to the results of the 2017 survey, approximately 40% of the enterprises surveyed had innovation activity and around 8% of them achieved 4 kinds of innovation; the innovation success rate of the manufacturing industry was relatively high and the innovation activeness of large-sized enterprises was the highest; cooperative innovation was conducive to enhancing market competitiveness; insufficient cognition of innovation, relatively high costs of innovation and lack of elements for innovation were believed to be the major obstacles to corporate innovation; and finally, the outcome of implementation of innovation policies was widely approved among the entrepreneurial groups.

**Key words:** enterprise innovation survey, entrepreneurial survey, technology innovation, innovation policy.

### Introduction

Innovation survey is one of the most straight forward means of garnering an update on the innovation activity of the enterprise. Globally speaking, the EU has a relatively long history of conducting the innovation survey, while China was relatively late. China conducted the first innovation survey of industrial enterprises in 2007 based on Oslo Manual (OECD, 2005).

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The scope of such survey was extended in 2015 to cover industry, construction and service sectors. In 2017, the enterprise innovation survey was further institutionalized to make it a routine annual survey. This paper, based on the data on *The 2017 Statistics Yearbook on National Enterprise Innovation Activity*, discusses the basic situation of Chinese enterprise innovation in 2016 and evaluations by entrepreneurs of innovative activity and innovation policies.

### **Basic Situation of Conducting the Enterprise Innovation Survey in China**

Before 2007, China's enterprise innovation survey was limited to the sampling surveys of part of the regions or some industries. In 2007, it engaged in an extensive survey, covering the entire industrial enterprises. After the national innovation survey system established, a national enterprise innovation survey in its real sense was conducted in 2015, its coverage extending to industry, construction and service sectors, where innovation activities were relatively concentrated (NBS, 2014, 2016). The survey practice in 2015 was basically continued in 2017, the specific survey scope including the industrial enterprises at above designated size<sup>1</sup>; Special Grade, Grades I and II General Contractor and Specialized Contractor enterprises; wholesale and retail enterprises at above designated size<sup>2</sup>; enterprises in the transportation, warehousing and postal, information transmission, software and IT service industries, and enterprises in the leasing and business service industries, scientific research and technology service sectors, and those in the water conservation, environmental protection and public utilities management sectors above designated size<sup>3</sup>.

The implementing agency for China to conduct enterprise innovation survey is NBS serving as the main body, with the Ministry of Science and Technology (MOST) and other relevant agencies participating in the development of survey plans and revisions of questionnaires (MOST, 2013).

In terms of the enterprise innovation survey, China has more used the EU's innovation questionnaires as reference for its survey contents (NBS, 2015). The contents of enterprise survey in 2017 mainly included basic information on various innovation activities of the enterprise, innovation input and output, industry-college-research cooperation, sources of innovation information, obstructive factors of innovation, and IPRs and related information. Unlike EU countries, a survey of entrepreneurs was specially designed for China's enterprise innovation survey, mainly involving the understanding of innovation, implementation of innovation related incentive measures, implementation of innovation policies, effects of innovation policy implementation, and development of innovation strategic goals (NBS, 2017).

Methodologically speaking, before 2015, China's innovation survey was conducted using the complete enumeration combined with the sampling survey. The complete enumeration was used for industrial enterprises at above designated size, and Special Grade and Grade I construction enterprises and provincial-level and above financial enterprises, and the sampling survey was conducted for enterprises in industry, and construction and service sectors below designated size (NBS, 2014). In 2017, China changed the sampling survey to the complete enumeration for the wholesale and retail enterprises above designated size, and the enterprises in the transportation, warehousing and postal business, information

transmission, software and IT service industries and those in the leasing and business sectors, and the water conservation, environmental and public utilities management industries.

In terms of survey cycle, based on the experience garnered from the twice enterprises innovation surveys, one in 2007 and the other in 2015, China's enterprises innovation has been incorporated into its annual routine statistical survey since 2017, i.e. the innovation survey was conducted on an annual basis. Such frequency of survey was far greater than most European countries (Xuan, 2014).

### **Main Characteristics of Innovation Activities Conducted by Chinese Enterprises**

*Approximately 40% of the enterprises had innovation activity and around 8% achieved 4 kinds of innovation*

In 2016, there were 284,000 enterprises engaging in innovation activity, accounting for 39.1% of the total number of enterprises, of which 262,000 achieved innovation, accounting for 36.1% of the total. The two percentages of the same in the 15 EU countries in 2014 was 55.7% and 53.0%. 57,000 enterprises achieved four types of innovation (production innovation, process innovation, organizational innovation and marketing innovation) simultaneously, accounting for 7.9% of the total.

In terms of percentage of enterprises that achieved innovation, there were significant differences between enterprises in the activeness of innovation. The activeness of innovation of industrial enterprises was the highest and the percentage of them achieving innovation reached 44.0%; and 26.8% and 27.7% of the enterprises in the construction and service sectors, respectively achieved innovation. Geographically, the percentages of enterprises that achieved innovation decreased in descending order from the east, central and west, to the northeast regions; there were about 39.0% of the enterprises in the east realizing innovation, while there were only 22.3% of them achieving innovation in the northeast.

*The success rate of innovation of manufacturing enterprises was relatively high and the innovation of large-sized enterprises was the most active.*

In 2016, of the 356,000 surveyed manufacturing enterprises above designated size, 141,000 conducted technology innovation activity<sup>4</sup>, accounting for 39.7%. On the other hand, the percentage of the same in the 15 EU countries in 2014 was 47.3%. Hence, China still lagged behind comparatively.

If we look at enterprises at difference sizes and scales, the innovation of large-sized manufacturing enterprises was the most active with the technological innovation enterprises accounting for 79.3%, which was higher than medium-sized enterprises standing at 58.4% and 2.2 times that of microenterprises. In respect of types of registered enterprises, foreign-funded enterprises and HK-Macao-Taiwan enterprises were relatively high in innovation activity and the percentages of them conducting technology innovation were 46.7% and 45.5%, respectively, both of which were higher than domestic enterprises standing at 38.7%.

There were a total of 118,000 manufacturing enterprises successfully achieving technology innovation, accounting for 83.4% of the enterprises undertaking technology innovation activity; there were 92,000 and 95,000 enterprises successfully achieving product innovation

and process innovation, accounting for 65.4% and 67.7%, respectively. Of the enterprises engaging in technology innovation activity, 40,000 suspended or failed in their technology innovation activity, accounting for 28.1%, significantly lower than the percentage of those achieving technology innovation.

*Cooperative innovation boosted the market competitiveness of enterprises.*

Cooperative innovation refers to the situation where the enterprise conducts technology innovation activity jointly with other enterprises or institutions, in order to fully garner innovation information or achieve the effective utilization of innovation resources, especially advantaged resources. Of the 192,000 enterprises undertaking technology innovation activity in 2016, 120,000 had cooperative innovation, accounting for 62.5%, which was far higher than the average level of 33.1% of the 15 EU countries in 2014. Among the 160,000 enterprises successfully achieving technology innovation, those with cooperative innovation accounted for 70.8%. It showed that cooperative innovation had become one of the important means of engaging in technology innovation activity of the enterprises. In terms of sizes of enterprises, the larger the size, the more openness they had in their innovation process. Among the SMEs and large-sized enterprises conducting technology innovation activity, those with cooperative innovation accounted for 60.1%, 65.9% and 76.2%, respectively.

The innovative output of cooperative innovation enterprises, especially those for industry-college-research cooperation was even stronger. Take industrial enterprises above designated size for example, in 2016, sales revenue from new products in the amount of RMB145,000 were achieved by those conducting cooperative innovation, accounting for 83.3% of the total industrial enterprises above designated size. Among the industrial enterprises above designated size that engaged in technology innovation activity, those with cooperative innovation realized an average of RMB160 million each in sales revenue from new products, which was 3.2 times that of those engaging in no cooperative innovation; those undertaking industry-college-research cooperation achieved RMB250 million each in sales revenue from new products on average, which was 4.8 times that of those conducting no cooperative innovation.

*Insufficient cognition of innovation, high costs of innovation and lack of elements for innovation were the major obstacles to innovation.*

In 2016, of over 283,000 enterprises conducting innovation activity, more than 50% believed that all of the 9 factors influencing the success of innovation would have relatively large impacts on achieving innovation. This showed that these factors played an important role in the success of innovation. In addition, over 70% of the enterprises believed that the first two factors, i.e. high-quality talents cognition and staff sense of identify were important.

60.9% of the enterprises surveyed did not engage in innovation activity, which was higher than the average level of 44.3% of the 15 EU countries in 2014. Besides, another 4.5% of them were yet to be successful or failed at innovation. The survey showed that weak awareness of innovation, relatively high costs and lack of elements had been the main causes for engaging in no or being unsuccessful in innovation. 20% of the enterprises that did not conduct technology innovation believed that their obstacle to innovation was “no necessity for innovation”, and 63% of these enterprises had no plans for innovation in the future. Of the

enterprises planning to engage in technology innovation in the future, 12.3% believed that their obstacles to innovation were attributable to the excessively high cost of innovation, 76.8% of which were microenterprises. Due to lack of fund for innovation, microenterprises tended to be more sensitive to the costs of and risks in innovation. Of the enterprises that were yet to be successful or met with failures in innovation, 30%, 28%, 23% and 18% believed respectively that the main obstacles to their innovation were attributable to the lack of innovative talents, fund support, market demand and information smoothness.

### **Evaluations by Entrepreneurs of Enterprises Innovation Activity and Governmental Innovation Policies**

*Most entrepreneurs viewed positively about the role of innovation.*

There were 4.197 million entrepreneurs<sup>5</sup> in the surveyed enterprises, with 5.8 of them in each on average. Among them, those at the age of 29 and below accounted for 12%, those aged 30-39 accounted for 32%, those aged 40-49 accounted for 37%, those aged 50-59 accounted for 17%, and those aged over 60 accounted for 2%. The percentage of young and middle-aged entrepreneurs was relatively high, injecting more vitality to innovation activity. In terms of educational background, the degree of education received by the entrepreneurs was positively correlated to the activeness of innovation activity, and the percentages of conducting innovation activity in the enterprises led by the entrepreneurs with a PhD, Masters and BA degree, a junior college diploma and others were 72%, 67%, 53%, 46% and 42%, respectively.

Most entrepreneurs viewed positively about the role of innovation. Of the enterprises conducting innovation activity, 37.0% believed that innovation played an important role in the survival and development of the enterprise; 57.3% believed that it played a role to some extent; and 5.8% believed that it did not play a role. The entrepreneurs believed that the product innovation played a more important role in corporate development. Of the entrepreneurs in the enterprises that achieved innovation, 31.6% believed the product innovation impacted most greatly on the corporate development, and 17.7%, 26.5% and 24.3% believed that process innovation, organizational innovation and marketing innovation, respectively, had the greatest impacts.

*The effects of innovation policy implementation were approved by the entrepreneurs.*

The survey made the enquires to the entrepreneurs in terms of effects of implementation of 10 innovation related policies. And five policies were approved by over a half of the entrepreneurs and only one policy was approved by less than 40% of them. Hence, the effects of implementation of innovation policies were generally accepted and supported by them. The percentages of entrepreneurs believing that the effects of various policies were relatively significant were 55.1% in relevant policies for creation and protection IPRs, 54.2% in relevant policies for encouraging enterprises to attract and foster talents, 51.2% in the support policy for prioritized industry development, 50.8% in the preferential tax policy of pre-tax deduction of R&D expenditure, 50.7% in relevant polices for financial support, 49.9% in high-tech enterprise income tax credit policy, 49.2% in various policies for boosting business startup and innovation by the general public, 44.9% in the policy for accelerated depreciation of

instruments and equipment dedicated to corporate R&D activity, 42.4% in the preferential tax policy of VAT exemption from income of technology transfers and development and tax credits for income from technology transfers, and 37.6% in the policy on the exemption from import duty for articles used for science and technology development.

The main causes for unobvious or no policy effects were relatively high policy barriers, relatively small scope of application, insufficient publicity and relatively low awareness. It was the hope of the entrepreneurs that government agencies should further improve policy making and execution to enhance the actual effects of policy implementation.

## **Conclusions**

The enterprise innovation survey carried out in China in 2017 not only covered an extensive area, including industrial, construction and service enterprises, but also conducted the complete enumeration of industrial enterprises and enterprises in the service sector above designated size. This means that China's enterprise innovation survey was at the forefront of the world intensively and extensively, and even surpassed developed countries in certain aspects. Through the analysis of results of this survey, a number of distinctive features of innovation activity conducted by Chinese enterprises can be discovered.

Firstly, the activeness of innovation activity of Chinese enterprises was very high, with approximately 40% of them conducting innovation activity. There were 262,000 enterprises that achieved innovation, accounting for 36.1% of the total; there were 57,000 enterprises that achieved four types of innovation simultaneously, accounting for 7.9%. The activeness of innovation activity of industrial enterprises was the highest with the percentage of enterprises that achieved innovation reaching 44.0%.

Secondly, the success rate of innovation of manufacturing enterprises was relatively high, and cooperative innovation helped to enhance their market competences. In 2016, of the 356,000 surveyed manufacturing enterprises above designated size, 141,000 conducted technology innovation activity, accounting for 39.7%; there were 118,000 manufacturing enterprises that successfully achieved technology innovation, accounting for 83.4% of the total enterprises engaging in technology innovation activity; there were 92,000 and 95,000 enterprises respectively achieving product innovation and process innovation, accounting for 65.4% and 67.7%, respectively.

The output capacity of cooperative innovation, especially industry-college-research cooperation was stronger. Among the industrial enterprises above designated size that engaged in technology innovation activity, those having cooperative innovation generated an average of RMB160 million in sales revenue of new products each, which was 3.2 times that of those conducting no cooperative innovation; those conducting industry-college-research cooperation realized an average of RMB250 million in sales revenue of new products each, 4.8 times that of those conducting no cooperative innovation.

Thirdly, insufficient awareness of innovation, relatively high costs of innovation and lack of elements for innovation were the major obstacles to enterprises innovation. 29% of the enterprises conducting no technology innovation believed the obstacle to their innovation to be "no necessity for innovation" and 63% of these enterprises had no plans for conducting innovation in the future. 12.3% of the enterprises engaging in no technology innovation

attributed their obstacle to innovation to the excessive high cost of innovation, 76.8% of which were microenterprises.

Finally, most entrepreneurs viewed positively about the role of innovation and approved the effects of innovation policy implementation. Of the entrepreneurs in the enterprises engaging in innovation activity, 37.0% believed that innovation played an important role in the survival and development of the enterprise, 57.3% believed that it played a role to some extent, and 5.8% believed that it failed to play a role. Of the 10 innovation policies listed in the questionnaire, 5 or more were approved by over a half of the entrepreneurs. The two policies with the highest cognition of the entrepreneurs were the policy on creation and IPR protection and the policy on encouraging enterprises to attract and train talents.

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1 The enterprise above state designated size refers to the legal person industrial enterprise whose annual revenue from principal business is greater or equals to RMB20 million.

2 The wholesale and retail enterprise above designated size refers to the wholesale legal person enterprise whose annual revenue from principal business is greater or equals to RMB20 million, and to the retail legal person enterprise whose annual revenue from principal business is greater or equals to RMB5 million.

3 The enterprise in any one of these five enterprises above designated size in the service sector refers to that legal person unit whose annual revenue from principal business is greater or equals to RMB10 million, or employees are greater or equal to 50 people.

4 Technology innovation refers to product innovation or process innovation.

5 Entrepreneurs refer to the top management, such as, Deputy GM or similar position and above in the enterprises.