The Characteristics and Challenges of Enterprise Innovation in China: Evidence from the National Enterprise Innovation Survey (Postprint)

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Abstract

[Purpose/Significance] The innovation vitality and innovation capability of enterprises are key indicators reflecting a country' s innovation level and also serve as an important reference for evaluating the effectiveness of innovation policy implementation. [Method/Process] This paper conducts data analysis on the statistical results of the 2015 National Enterprise Innovation Survey by the National Bureau of Statistics, summarizing the current progress and main issues in enterprise innovation. [Results/Conclusion] China' s enterprise innovation has entered a rapid development period characterized by expanded scale, enriched forms, and strong potential, presenting a favorable situation where multiple industries develop concurrently, various types advance simultaneously, and most entrepreneurs attach great importance to it. However, innovative enterprises remain a relative minority, the difficulty in highlighting innovation effects weakens the motivation for enterprise innovation, the gaps in innovation performance are substantial both internally and externally, and the overall innovation vitality remains insufficient. The innovation capabilities of most enterprises have entered a climbing and tackling stage, facing multiple challenges including inadequate intellectual property protection, talent shortage, high costs, and insufficient open cooperation. Therefore, the government must play its role correctly and efficiently—both by eliminating resource allocation distortions in fostering an innovation environment, and by helping enterprises compensate for their shortcomings in intellectual property protection, innovation talent incentives, innovation cost reduction, and open cooperation promotion, continuously expanding the innovation community and enhancing the motivation and capability for enterprise innovation.

Full Text

Preamble

Research on the Features and Challenges of Firm Innovation in China: Evidence from the National Firm Innovation Survey

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Abstract

[**Purpose/significance**] Firm-level innovation vitality and capability are not only key indicators reflecting a nation' s innovation capacity, but also important references for assessing the effectiveness of innovation policy implementation. [**Method/process**] This paper analyzes the statistical results from the 2015 National Firm Innovation Survey conducted by the National Bureau of Statistics, summarizing the progress and major challenges in current firm-level innovation. [**Result/conclusion**] Chinese firm innovation has entered a rapid development phase characterized by expanding scale, diversified forms, and strong potential, presenting a favorable landscape of concurrent innovation across multiple industries, various innovation types, and broad recognition among entrepreneurs. However, innovative firms remain a relative minority, and the difficulty in achieving prominent innovation outcomes has weakened firms' innovation incentives. Significant gaps in innovation performance persist both internally and externally, and overall innovation vitality remains insufficient. Most firms' innovation capabilities are entering a critical 爬坡 (climbing) and 攻坚 (breakthrough) stage, facing multiple challenges including inadequate intellectual property protection, talent shortages, high costs, and insufficient openness and collaboration. Therefore, the government must play its role correctly and effectively—by eliminating resource allocation distortions to foster an innovation-friendly environment, while also helping firms address their critical shortcomings in IP protection, talent incentives, cost reduction, and collaborative innovation to continuously expand the innovation community and enhance firms' innovation motivation and capability.

Keywords: innovation survey; firm innovation; innovation vitality; innovation capability

As China' s economic development enters a new stage emphasizing quality improvement and efficiency enhancement, innovation has become the primary driver for structural adjustment and industrial transformation and upgrading. Enterprises, as the main vehicle for integrating science and technology with economic development and as one of the most important innovation actors, represent key indicators of China' s innovation quality and efficiency, as well as crucial references for analyzing the implementation effects of innovation-driven

development strategies. Using the statistical results from the 2015 National Firm Innovation Survey conducted by the National Bureau of Statistics, we conducted large-sample data analysis and comparison to summarize the main features of current innovation activities in Chinese firms. This depiction of the overall landscape of firm innovation and analysis of key bottlenecks will provide valuable references for both government policymakers and enterprise managers.

1. Chinese Firm Innovation Has Reached Considerable Scale and Entered a Period of Rapid Expansion

Over three decades of rapid catch-up development have laid a solid foundation for firm innovation in China. Since entering the New Normal, both the number and proportion of firms conducting innovation activities have increased substantially, particularly in technology-intensive industries. Simultaneously, multiple types of innovation activities are being pursued concurrently, and the sources of innovation information are becoming increasingly diverse. A new generation of entrepreneurs also generally attaches great importance to innovation.

1.1 The Scale of Firm Innovation Activities Has Increased

During 2013-2014, among the 646,000 firms surveyed, 266,000 had engaged in innovation activities, accounting for 41.3% of the total. This represents a substantial increase compared to a decade earlier. In the industrial sector, for example, the proportion of firms conducting innovation activities grew from 28.8% a decade ago to 46.8%. Moreover, fields with high innovation activity are predominantly distributed in technology-intensive industries.

1.2 Multiple Types of Innovation Activities Are Pursued Concurrently

Currently, the proportions of Chinese firms engaged in product innovation, process innovation, organizational innovation, and marketing innovation have reached 18.7%, 20%, 27.9%, and 25.8%, respectively. This indicates that while firms emphasize technological innovation, they also pay greater attention to improving management efficiency and innovating business models, thereby expanding the scope of innovation. In terms of activity forms, beyond internal R&D and purchasing machinery, equipment, and software, firms also emphasize related training, market promotion, and other innovation activities, striving to enhance their absorptive capacity and market capabilities.

1.3 Innovation Information Sources Are Becoming Diversified

In the past, Chinese firm innovation was primarily characterized by following and imitation, with information sources for product or process innovation mainly coming from foreign counterparts or international institutions, resulting in insufficient original innovation and low-level innovation. Today, customers, universities and research institutions, government agencies, industry associations,

the internet, and internal sources within enterprise groups have all become important sources of innovation information, substantially enhancing innovation potential.

1.4 A New Generation of Entrepreneurs Rises, with Most Emphasizing Innovation

The entrepreneur cohort is characterized by youthfulness and high educational attainment. Entrepreneurs under 50 years old account for nearly 80% of the total; in some high-tech or emerging industries, those under 30 exceed 15%. In terms of education, over 80% of entrepreneurs hold college degrees or above. Additionally, most entrepreneurs recognize the importance of innovation. Nearly 90% believe that innovation plays either an "important role" or "some role" in firm survival and development.

1.5 Innovation Has Directly Driven New Product Market Expansion

During 2013-2014, 100% of industrial firms that achieved product innovation had "new products for their own enterprise," over 60% had "new products for the market," and more than 20% had "new products for international markets," making new product market expansion a direct outcome of current firm innovation. Meanwhile, firms' total sales revenue from new products in 2014 exceeded 23 trillion yuan, accounting for 13.1% of their main business revenue.

2. Limited Innovation Activity, Insignificant Innovation Returns, and Large Gaps Among Different Innovation Actors

Despite the increased scale of firm innovation, the overall innovation vitality of Chinese firms remains insufficient when considering the urgent need for innovation-driven development under the New Normal and compared with some internationally innovative developed countries. Innovation activities are still largely confined to a minority of firms, and the lack of prominent innovation outcomes has suppressed firms' innovation enthusiasm. Significant gaps also exist in innovation performance among different domestic firm types and sectors.

2.1 Innovation Remains Largely Confined to a Minority of Firms, with Input Intensity and Output Quality Lagging Behind International Advanced Levels

Although the proportion of Chinese firms conducting innovation activities rose to 41.3% in 2013-2014, this remains below the 52.9% average for EU-27 countries during 2008-2010. The proportion of firms engaged in technological innovation was only 26.9%, lower than Germany' s 55%, Japan' s 27.5%, and South Korea' s 37.2%. Moreover, the gaps are even more pronounced in innovation input intensity and output effects. Compared with Germany, China' s manufacturing

innovation expenditure intensity was only 1.58% in 2014, far below Germany' s 4.5%. The profit contribution from technological innovation was also limited: new product sales revenue accounted for 14.5% of total revenue in Chinese manufacturing, still below Germany' s 23.3%.

2.2 The Economic Benefits of Firm Innovation Are Not Significant, Suppressing Innovation Motivation

Innovation contributes very limitedly to firms' current profits. Among the 378,000 industrial enterprises above designated size surveyed during 2013-2014, the overall average profit margin was 6.22%. Firms with innovation activities averaged only 6.28%, while those without innovation activities averaged 6.09%—firms conducting innovation did not show significant profit gains over non-innovating firms. This partially explains the current lack of innovation motivation and indicates that many firms have not yet truly entered a development stage where they can rely entirely on innovation to excel.

The underlying reasons warrant careful consideration. Beyond the possible lag in innovation input effects, this situation primarily relates to firms' low innovation levels, high innovation risks, and the external environment for capturing innovation returns. Due to either a lack of original innovation, positioning at the middle and low ends of industrial value chains, or dependence on others for key technologies and basic components, most firms face coexistence of low-level, high-cost, and low-benefit innovation activities. They must confront issues such as low product added value, low market recognition, and high sunk and switching costs, where "latecomer disadvantages" far outweigh "latecomer advantages," naturally limiting innovation' s profit contribution and exacerbating the high failure rate of innovation investment. Additionally, some firms can profit merely through non-market means to occupy monopolistic positions or even through regulatory violations and infringement, while innovative firms are constrained by unfair competition or having their innovation outcomes improperly "copied," making it difficult to realize deserved innovation returns and even creating a "bad money drives out good" phenomenon.

This situation not only suppresses firms' endogenous innovation motivation but also reduces entrepreneurs'perceived necessity of innovation to some extent. The survey shows that 14.6% of entrepreneurs believe innovation plays "no role" in their firms, with this proportion being even higher in some traditional industries. Many firms in traditional industries are currently facing operational pressures to reduce overcapacity, destock, and cut costs, often leaving them with little capacity to attend to innovation.

2.3 Large Gaps Exist in Innovation Performance Among Firms of Different Sizes, Ownership Types, and Industries

Gaps related to firm size: Small firms, accounting for over 70% of the total, lag behind large firms (accounting for less than 10%) in both innovation

motivation and effects. In the industrial sector, for example, only 29.6% of small firms engaged in technological innovation, compared with 75.3% of large firms. Small firms' new product sales revenue accounted for only 4.8% of their total revenue, while large firms reached 22.1%.

Gaps related to ownership type: State-owned and collective enterprises show relatively insufficient innovation motivation and weaker innovation performance compared with private and foreign-funded enterprises. Nearly 20% of state-owned enterprises lack innovation motivation, higher than the 14.3% among private enterprises. This is related to excessive regulation and insufficient competition in some sectors.

Gaps related to industry type: The service sector' s innovation level lags behind manufacturing overall. The proportion of service enterprises lacking innovation motivation was 23.9%, far higher than manufacturing' s 13.9%. Only 32.6% of service enterprises conducted innovation activities, below manufacturing' s 48.2%. Insufficient innovation in the service sector not only affects productivity improvement but also hinders structural adjustment and economic growth.

3. Firm Innovation Capability Has Entered a Critical Breakthrough Phase, Facing Multiple Obstacles

The development of Chinese firms' innovation capabilities has entered a crucial 爬坡 (climbing) and 攻坚 (breakthrough) stage, facing multiple obstacles. These are mainly manifested in: backward approaches to protecting innovation achievements, severe shortages of innovative talent and persistently high costs, and low levels of openness and collaborative innovation.

3.1 Firms' Capacity to Protect Intellectual Property Is Inadequate

Along with the rapid increase in innovation output quantity, Chinese firms have begun emphasizing the protection of innovation achievements. However, current IP protection methods are relatively singular and low-level, and firms' capacity to protect innovation achievements urgently needs improvement. Chinese firms most commonly adopt "internal protection of technical secrets" and "leveraging first-mover advantage in timing" as protection methods, with corresponding proportions of 12.3% and 17%. In contrast, only 7.3% of firms have applied for patents, only 6.3% have established national or industry technical standards, and a mere 2.5% employ complex technologies that are difficult to replicate.

This situation partly indicates that Chinese firms' cognitive level and capacity for IP protection are relatively backward, and more importantly, it reflects an imperfect environment for IP protection. Inadequate punishment for infringement in the past has led to low infringement costs and high rights-protection costs. Combined with the influence of technological characteristics in some industries, firms have had to resort to internal secrecy or "timing advantages" as

protection methods.

3.2 Firms Face Severe Shortages of Innovative Talent and Excessively High Innovation Costs

Innovation is characterized by high investment, high risk, and high thresholds, with innovation capabilities encountering specific obstacles at different development stages. This survey examined 12 hindering factors and found that, beyond insufficient motivation, talent shortages or brain drain and excessively high innovation costs are the two most prominent constraints on Chinese firm innovation.

In entrepreneurs' view, "people" are the most important factor affecting innovation success; lack of talent or brain drain has become the primary obstacle to Chinese firms' innovation activities. This situation is extremely mismatched with China' s advantageous position as the world' s largest country in R&D personnel scale. The reasons relate to both backward incentive mechanisms for innovative talent and insufficient market-oriented mobility of researchers, lack of creativity and inclusiveness in talent cultivation, and inflexibility in talent introduction mechanisms.

Excessively high innovation costs and lack of stable funding sources constitute another major obstacle constraining the improvement of Chinese firms' innovation capabilities. Firm innovation requires long-term, stable investment, and excessively high innovation costs not only weaken motivation but also hinder the enhancement of innovation capabilities. For Chinese firms, on the one hand, R&D costs directly related to innovation investment are too high. While direct introduction of core technologies has become difficult, internal R&D involves long cycles and high uncertainty, while external sources such as bank credit, government subsidies, and guidance funds are very limited, keeping capital costs high. On the other hand, some institutional and opportunity costs are also high, such as tax burdens, property protection, industry access, and inter-industry differences in relative returns, which represent hidden costs for firms to increase innovation. Additionally, the current domestic financial system' s support for the real economy is relatively insufficient, and a multi-level capital market conducive to the growth of innovative enterprises has not yet been established.

3.3 Innovation Openness and Collaboration Are Insufficient

Current firm innovation activities suffer from insufficient openness and weak capacity to utilize and integrate external resources, with at least three types of imbalances. First, firms rely mainly on internal innovation with limited external innovation, and direct technology introduction has become increasingly difficult. Second, there is a serious imbalance in innovation expenditure between internal R&D and external R&D. Third, the ratio of innovation achieved through independent development versus collaborative development is also imbalanced.

Firms' willingness to engage in innovation collaboration is weak, with insufficient

collaboration along the innovation chain. Only 20.1% of firms have engaged in innovation cooperation, and industries or firms with less innovation activity also show lower levels of innovation collaboration. Meanwhile, firms prefer to choose partners upstream and downstream in the industrial chain, such as suppliers and customers, while generally showing lower selection rates for partners along the innovation chain like universities, research institutions, government agencies, and venture capital. This situation not only hinders the expansion of firms' innovation ecosystem networks but also exacerbates the disconnect between industrial and innovation chains.

The depth of industry-university-research collaboration in Chinese firms is also very limited. In terms of collaboration forms, most collaborations focus on jointly completing research projects or hiring university and research institution personnel as part-time employees in firms, while the proportion of establishing joint R&D institutions is not high. This indicates that current industry-university-research collaborations remain focused on solving temporary research projects, and a collaborative innovation system with deep cooperation has not yet been formed.

4. Conclusions and Implications: How Government Can Effectively Stimulate Firm Innovation Motivation and Enhance Innovation Capability

After decades of rapid catch-up development, Chinese firm innovation has entered a rapid development period of expanding scale, diversified forms, and strong potential, demonstrating a new situation and trend of "mass entrepreneurship and mass innovation." Firm innovation is accelerating its transformation from "quantity expansion" to "quality improvement," which is conducive to cultivating new drivers for economic growth during the transition period, helping several industries move toward the medium-high end, and leading the economy steadily into the New Normal. Large-sample survey analysis of firm innovation reveals that concentrated breakthroughs in the current development bottlenecks of Chinese firms'innovation motivation and capability are urgent tasks for deeply implementing the innovation-driven development strategy.

To motivate non-innovating firms to invest in innovation and enable innovating firms to better capture innovation returns, the government must play its role correctly and effectively. The government should respect the market-oriented laws of innovation activities, neither substituting for firms and markets in making judgments, setting directions, and allocating resources, nor using rigid assessments of individual intermediate indicators to evaluate short-term innovation effectiveness. Particularly in fostering an innovation environment, the government should focus on eliminating institutional barriers or policy discrimination caused by improper intervention or inadequate supervision, reversing inefficient allocation of innovation resources in some sectors, reducing the "crowding-out effect" of non-market behaviors on innovation, and expanding the innovation

community.

As a new round of technological revolution and industrial transformation accelerates and growth drivers undergo stage transitions, there is an objective requirement for Chinese firms' innovation capabilities to leap from a state of "catching up and running in parallel" with "catching up" being dominant to one of "running in parallel and leading" being dominant. Improving traditional innovation methods and addressing multiple shortcomings in innovation activities also requires active government involvement. In light of current circumstances, government action in five areas urgently needs strengthening:

First, increase penalties for intellectual property infringement, effectively reduce rights-protection costs, and ensure reasonable and legitimate returns from innovation. Second, improve the mechanisms for introducing, evaluating, and incentivizing innovative talent, and enhance entrepreneurs' innovation literacy. Third, adopt multiple measures to help firms reduce innovation costs, such as increasing tax reduction intensity for R&D investment by small and private firms, and improving the support intensity and operational efficiency of government guidance funds for common technology R&D. Fourth, create conditions in terms of resource sharing, factor mobility, and reform of the investment and financing system to stimulate firms to enhance capabilities through open and collaborative innovation and expand innovation networks. Fifth, accelerate the elimination of backward production capacity, strengthen the "forcing effect" of fair competition, regulatory constraints, and price mechanisms on firm innovation, and promote more bottom-up social innovation.

Note: All statistical data used in this paper are derived from the questionnaire statistics of the 2015 National Firm Innovation Survey conducted by the National Bureau of Statistics.

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Note: Figure translations are in progress. See original paper for figures.