China's National Innovation System: An Analysis of Innovative Performance, Key Actors, and Policies

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In the current Science & Technology Development Plan (2006 – 2020) the Chinese Government has stated the ambition to become an innovative nation by 2020 and a world leader in science and technology by 2050. Quite in contrast to the common perception of the global workbench and an economy infamous for infringement of intellectual property rights, the development of indigenous innovation as a vehicle for the creation of core technologies crucial for economic development takes the most prominent position in the policies of the Development Plan. China’s government is highly concerned with increasing the country’s inventiveness and overcoming domestic economic, social, and environmental problems by means of technology.

Research Objective

Inspired by the obvious discrepancies between the attributes “global workbench”, “challenging environment for the protection of intellectual property”, and “future hotbed for indigenous innovation”, this paper addresses two main questions. The first one is concerned with the innovative performance of actors in China’s National Innovation System (NIS). The second one scrutinizes the Development Plan’s implications for the innovative performance of the population of actors within China’s NIS's.

To address the first question, the methodology employs a literature review and a complementary measurement of innovative performance based on patent-application statistics. Building on this set-up, three value-classes of innovation are derived. This allows for cross-country comparison of China, and the USA and Germany as benchmark-countries, as well as an analysis of the most active applicants within China’s NIS according the three value classes. In order to address the second question it is examined how the strict implementation of the Development Plan’s policies could possibly modify the population of actors and their respective innovative performance within China’s NIS.


The measurement of China in comparison to the United States and Germany shows the overall improving innovative performance of China’s NIS in the period 1990 – 2005. Especially in the low value class, the Chinese applications outperform the applications filed by the United States and Germany after 2000. Although China experiences a trend of quantitative growth in this value class, the measures also reveal China’s difficulties to create innovative performance of higher economic value. Measured by patent applications of medium and high value classes, China is lagging behind in terms of absolute applications.

The entry in the WTO in 2001 and the corresponding enforcement of the TRIPS agreement are important events. The growth rate of international patent application shows strong momentum for that year and increases further afterwards. The enforcement of TRIPS assumedly increased domestic patenting activities, due to international harmonization of the patent system. Especially the patent application growth rate of the medium value class has been rising considerably since 2001 which shows potential for a catching-up process.
Comparison of China, the United States, and Germany (1990 – 2005). Low, Medium, and High Value Classes in Absolute Values on the Left, in Normalized Values on the Right.
Key Actors in China’s National Innovation System 2003 - 2005

Universities and domestic firms contribute strongly to the innovative performance associated with lower economic value. The innovative performance of higher economic value is dominated by foreign firms. Further, public research institutes perform poorly, while a few individual applicants are active in the contribution of innovative performance of lower economic value, albeit declining. Generally, firms are the most important type of key actors. In particular, foreign firms contribute innovative performance of medium and high economic value to the overall performance of China’s NIS. The countries of origin of the firms in the sample are: Finland, France, Germany, Hong Kong (PRC), Italy, South Korea, Netherlands, Singapore, Sweden, Taiwan (PRC), and the United States (alphabetical order).

The most prominent companies among the top performers of the three value classes are Korean LG, Chinese Huaweii, Taiwanese Foxconn and Hongfujin, and French Alcatel. The top university is Zhejiang University, while the top individual applicant is Qiu Zeyou. A research institute of CAS is ranked 3rd in the high value class in 2003. Generally, with increasing economic value the internationality within the value class increases as well.

Implications for Innovative Performance

Based on the findings of the descriptive analysis and the measurement of the innovative performance the population of firms and other key actors of China’s NIS is constructed. The population is characterized by a high presence of domestic imitators and foreign pioneers, while domestic adaptionists and complementors are represented to a medium degree. The share of domestic pioneers within the population is small. The overall constellation is stable but represents a worst-case scenario for the development of domestic pioneers. Given this distribution, the bulk of radical innovation is contributed by foreign pioneers, while incremental innovation is created by domestic firms. However, due to weak linkages and a low absorption capacity of domestic entities, the spillover of knowledge and technology is limited.

Policy Measures to Improve the Innovative Performance

The authors of the most recent S&T Development Plan stress the development of indigenous innovation as the mean to improve the innovative performance of China’s NIS. Correspondingly, these authors emphasize China’s ambition to become an innovative nation by 2020 and a world leader in science and technology by 2050. In order to reach these goals, a range of policies are introduced in the plan.

Tax policies, amendments or procurement laws, strengthening of IPR, and the development of national technology standards should foster the development of indigenous innovation and increase the frequency of innovation. Once implemented successfully, the distribution within the population can change towards a constellation that is more supportive for domestic pioneers, adaptionists and complementors, while domestic imitators and in particular foreign pioneers face constraints. This constellation favors the development of indigenous innovation but is considered non cost-efficient.

The possible negative effects can be decreasing social welfare, decreasing productivity and the decrease of indigenous innovation if the development of own standards fails. Additionally, in line with findings of theoretical and empirical studies on competition and intellectual monopoly, a range of policy measures is discussed. In particular the length of patents is
evaluated critically due to the extension of China’s market and the expansion of trade-flows. If the domestic pioneers fail to compensate the knowledge originally internalized from the foreign pioneers, the S&T Development Plan will remain another wasteful experiment of ideological self-reliance.

Population of Actors in China’s National Innovation System before and after the Implementation of S&T Development Plan

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<tr>
<th>Domestic</th>
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<th>Pioneers</th>
<th>Foreign</th>
<th>Pioneers</th>
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<td>Pre Plan</td>
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<td>Post Plan</td>
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<td>Tax Policies</td>
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<td>Procurement Law</td>
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<td>Standard Setting</td>
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Note: (+) indicates a positive effect, (-) indicates a negative one. (+/-) refers to the fact that China’s national standards are affecting domestic pioneers positively on the national, but negatively on the global market as long these standards differ from common international standards.

Selected References


