

HOW DOES CHINA INNOVATE?

A deconstruction of China's national innovation system

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Abstract. *After 40 years of outstanding economic growth, China has become the world's second largest economy. Development's low-hanging fruits have already been collected and a model of low-value manufacturing is no longer sustainable. Therefore, China is shifting towards a knowledge economy. This paper explores the country's deployed policies and instruments towards innovation and technological progress.*

Policy-making in China should be seen through the lens of a structured uncertainty. Governance in China is decentralized and innovation policy varies significantly from region to region, as well as from industry to industry.

The Chinese state is not and does not aim to be a principal actor in the national innovation system, except for strategic sectors. It rather increasingly aims to become a partner for private actors, a facilitator and a platform-creator.

Funding for R&D and innovation is increasingly led by the market, including funding that comes from public sources and is tunnelled through public private partnership. Funding for R&D is also highly-atomized.

Experimentation, pilot-projecting and non-regulation are essential innovation policy instruments. Outbound and inbound foreign investment are also key elements for China's technological progress.

Keywords: *R&D expenditure, innovation policy, outbound and inbound foreign direct investment, experimentation, venture capital, start-ups.*

Introduction

After four decades of economic reform, China has declared its ambition to become a world leader of innovation. The country, its workforce and environment resources have reached the limits of expansive growth and thus, a new path is needed: innovation and technological upgrade. This paper's main question are:

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- What are the roles played by the government and market forces in China's national innovation system?

- What are the fundamental mechanisms, structural causes, policies and institutional arrangements that drive China's transition to a more innovative economy?

This study does not attempt to assess how innovative China is, but will explain how it actually innovates.

The National Innovation System (NIS) is the most widely deployed theoretical framework in innovation studies (Freeman, 1987). The paradigm sees innovation as a complex, multi-layered arena of interaction between domestic companies, foreign companies and government (Li 2017). It emphasises the interactions between the agents in the national innovation system, rather than the agents themselves.

The paper will analyse China's role as both a destination and a source for foreign direct investment (FDI). While initially China only absorbed FDI, it now gradually transforms into a net investor. The paper will highlight the important role played by inbound and outbound FDI in China's innovation system since the opening up, as well as the complex interactions between investing companies and the state.

Secondly, the paper describes the burgeoning start-up ecosystem and new emerging methods of funding in public-private partnership. It further discusses private and public funding for R&D, in terms of sources, destinations and structure.

Not the least, the study approaches the shifting role of the Chinese government within the national innovation system, highlighting the diverse public policies deployed. It brings into attention the case of new energy vehicles (NEVs) which, through the efforts of private stakeholders and all-round support conferred by Chinese government, achieved to be one of the best performing emerging industries in China.

Foreign Direct Investment

In the first decades of economic growth, China has been a large receiver of FDI and technological input. This transformed radically its national innovation environment. Foreign companies are the ones that basically set up China's modern industrial ecosystem, supply chains and management structures. The number of research centers established in

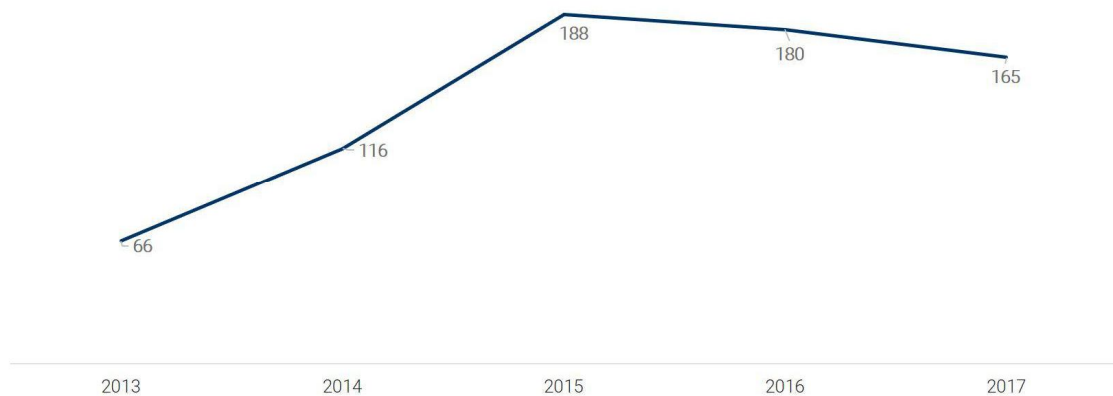
China by international companies has exceeded 1.500 units by 2014 (Yip and Mc. Kern 2016).

This spilled over to local companies, which absorbed new business models and technologies. Chinese companies climbed the learning curve, starting from imitation and process innovation, continuing to incremental and radical innovation, and eventually becoming truly competitive themselves. Sometimes, their brands and products reached to enjoy huge popularity on the Chinese market and have become indispensable for daily life. However, they had little to no success in penetrating foreign markets, for reasons that exceed the scope of current research.

As a means to expand, Chinese companies started to invest abroad themselves, especially in the form of M&As. Over the last decade, China's OFDI investments have increased rapidly, especially in developed markets, and peaked in 2016, when FDI doubled towards Europe and tripled towards North America, as compared to the previous 2015. A large part of investments abroad falls in the category of M&As.

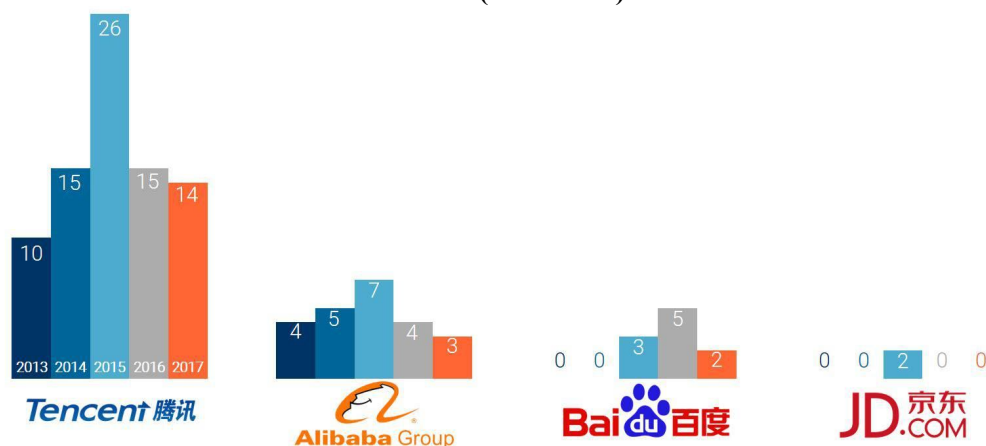
Technology oriented investments have become predominant in Chinese outbound FDI flows especially since 2017, when the Chinese Government imposed restrictions on other categories of ventures.

**Acquisitions deals of US-tech companies by Chinese companies
Total no. (2013-2017)**



Source: CBInsights, 2018.

**Most active Chinese companies in acquisitions of US-tech companies
No. deals (2013-2017)**



Source: CBInsights, 2018.

Venture capital, start-ups and private R&D spending

China is one of the main actors on the global venture-funding scene. It is powered by a dynamic ecosystem of investment platforms, angel investors, start-up incubators, accelerators, foreign investors and, to an important extent, by large tech corporations, such as Baidu, Alibaba and Tencent. Funding venturing in China is carried by both private VC funds (mostly BAT – Baidu, Alibaba and Tencent) and “government guidance funds”.

Spending for R&D is highly atomized across industrial sectors and population of companies. A large number of firms are engaged in experimental research, which enhances incremental innovation throughout all sectors of economy. However, very few companies are financially strong enough to engage in frontier research and breakthrough innovations. China has no champions to compete American high-tech giants such as Amazon, Alphabet or Microsoft. Promising exception are Huawei, one of the world’s top research spenders, and Alibaba, the first Chinese firm to join The Top 10 Most Innovative Companies (Strategy&, 2017).

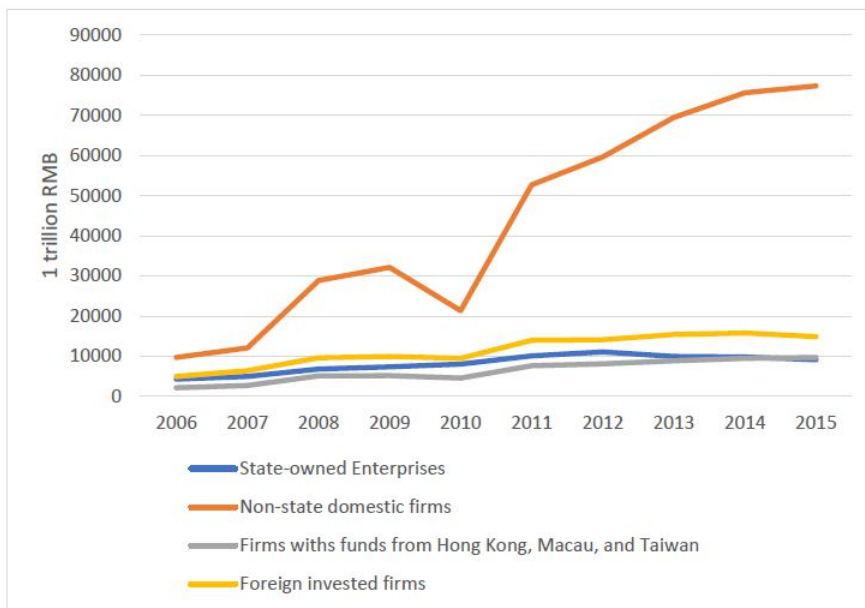
If coordinated with continued increase in R&D intensity, better resource allocation and more emphasis on basic research, private R&D funding in China can contribute tremendously to the country’s innovation aims.

The role of Government in the national innovation system

Contrary to popular belief, the Chinese government is limited in its capacity and willingness to intervene. Both statistics and policy statements prove that the Chinese government is more often than not a facilitator, strategic planner and platform-creator for a market-driven innovation, rather than a strong player itself.

Government funding for research is consistent with its surprisingly low participation in total industrial output. Following the reforms in the late 1990s, the share of state-owned enterprises in the total number of firms existent in China dropped significantly from 24 percent in 1995 to 3 percent in 2014. However, most of the surviving state-owned enterprises are relatively big, and positioned in upstream industries or strategically important sectors (Hsieh and Song 2015).

Total value of industrial output by ownership types of firms (2006-2015)



Source: China S&T Statistical Yearbook 2007-2016 (compiled by Li Yin, 2017).

As regards foreign firms, the Chinese government is accused of imposing on foreign companies the transfer of technology and production to China as a condition for market access (Hout and Ghemawat 2010); pressing them to license technology on Chinese firms at favourable rates and even conducting state-led technology-theft. While these allegations might be well-founded in certain industries, it is also reasonable to affirm

that in other industries, the government has conferred massive privileges and subsidies to foreign firms, in the detriment of domestic ones.

The Chinese government has specific priority sectors where it invests massively. Such are the cases of wind turbines, high-speed rail, aircraft engines, and space-related industry. Another example is that of supercomputers, where, after massive investments, China now owns the world's 1st and 2nd most performant units. Artificial Intelligence (AI) is one of the new focal points in policy planning, first emphasized in the Internet Plus strategy, launched in 2015.

Electric cars might be the next innovative industry where China takes the lead with a strong central push. Overall, NEVs emerges as the first automobile sector where Chinese domestic manufacturers are truly competitive. Combined with extensive Government support, leading technology and scaling-up capacity, the future of the NEV market belongs to China more than any other industry.

Pilot-projecting and experimentation

In 1980, Shenzhen, a small, unknown town, was established as China's first special economic zone (SEZ) – a policy experimentation playground. It quickly became one of China's most attractive cities for foreign investment and research, with an individual GDP that exceeds those of Hong Kong, Singapore and Israel. Major technology companies have their headquarters and research centres located in Shenzhen, including Huawei and ZTE, which are the top two companies in the world by the number of patents applications. This paved the way for future nation-wide reforms, which are first experimented with within the boundaries of small areas.

Experimentation is particularly significant when explaining China's leadership in areas such as fin-tech and e-commerce, where all-encompassing platforms with innovative business models are dominating the market. In the case of electronic payment systems, such applications emerged in the context of an underdeveloped financial market, as well as low financial education. China skipped over the stages of checks and credit/debit cards, directly to Alipay and Wechat Wallet, while the former became world's largest mobile payment platform. On the contrary, financial markets in US and Europe are well established and thus, resilient to change and innovation.

Discussion

This paper highlighted the underlying dynamics of innovation in China as shaped by funding for research, governmental intervention, foreign companies, investments abroad and other relevant factors. Despite its holistic approach, the analysis draws attention to the fact that economic circumstances and government policies differ greatly amongst geographical regions, as well as amongst industrial sectors.

The government prefers to direct extensive funding towards a limited number of domains. Therefore, R&D in China is strongly market-driven, financing is largely carried by the private sector, whereas the state contributes with little financial or fiscal incentives.

The government plays complex roles within the innovation system, including: prioritizing strategic sectors with generous resources and favourable policies, stimulating the transfer of foreign technology, promoting tech independency, stimulating outbound investments and protecting domestic companies from foreign competition. There are indeed specific sectors where the government considers necessary to intervene strongly, limit foreign investments and distort markets. Nevertheless, a new policy perspective is increasingly gaining traction. Most recent S&T strategies strongly emphasise the role of business-led innovation and the goal to commercialize technology. The state clearly aims to become a platform creator, facilitator and strategy-setter rather than a principal actor itself, in a trend of increasing policy sophistication.

Chinese innovation ecosystem is positively influenced by foreign-funded research. However, according to GII 2017 compiling data from UIS Online database, just 0.74% of gross expenditure for R&D is financed from abroad sources, ranking China on a very low 90 spot.

Consequently, Chinese' companies show a growing willingness and ability to purchase companies from abroad, as an effective means to secure brand names, market access, global talents and fresh technologies. Direct exposure to foreign markets enhances their innovation capacity, as a result of increased competition and knowledge transfer. Outbound FDI has been growing exponentially since 2005, but have recently suffered setbacks due to capital controls in China and increased scrutiny in countries of destination.

Overall, the Chinese tech sector is expanding and benefits from strong public support, aiming at stepping overseas and setting the world standards. However, at this stage, China lacks innovation champions that can truly challenge American tech giants. It also faces severe challenges

and dependencies in critical sectors such as semiconductors. On the other hand, China might be more dynamic and able to penetrate emerging markets which need cheap and reliable technology.

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