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## Abstract

Innovation has an increasing role in the economic progress of China. With Chinese patent applications surpassing those of Western countries, we aim to understand what is the actual perception and understanding of the value and importance of intellectual property (IP) on the ground in China. This paper reports insights from a field trip across 3 key innovation clusters in China (Beijing, Shenzhen and Shanghai). We conduct an ethnographic study using 20 semi-structured interviews with academics and researchers, representatives from enterprises and economic service firms as well as university leaders and policy makers. The results reveal a high level of IP awareness in China. Whether academics, governmental representatives, entrepreneurs or venture capital executives, all interviews reveal a strong understanding and visibility of the importance of IP. Governmental rules for subsidizing patent applications seems to be changing in China in order to move from quantity to quality. While at least the leading universities have established technology transfer offices (TTOs), there still a need for improve service offerings given that these are still offered by IP law firms. Moreover, leading universities offer occasional IP guest lectures and they are in the process of installing IP. In addition, investors seem to understand the importance of IP when making investment decisions. We identify a positive speed of which Chinese innovation system actors are becoming increasingly IP savvy. At the same time, China's large market size makes it less attractive to consider international IP strategies in early stages of a business. After succeeding in China, companies tend to prefer expanding into other Asian markets first, before venturing into Europe or the US.

**Keywords:** Intellectual property awareness, intellectual property rights, intellectual property value, China, innovation system

## 1. Background Introduction

Over the past three decades, China has experienced tremendous economic growth (Lo et al. 2019). During that period, China grew much faster than European countries and the United States (Ross et al. 2016). While its considerable economic growth is often attributed to foreign direct investment and human capital (Lo et al. 2019), innovation is also likely to have played an important role for China's success.

Innovation as a key determinant of economic growth is widely examined in academic literature (Cockburn et al. 2018, Lo et al. 2019). Patent data is often used as a proxy for innovation and technological development (Harhoff et al. 1999, Popp 2006). Indeed, annually granted Chinese patents have increased substantially over the same period and while patents are known to vary greatly in value and quality (Aristodemou, 2020, Aristodemou et al., 2018a,b), they are generally a valuable indicator for further investigation on innovation ecosystems.

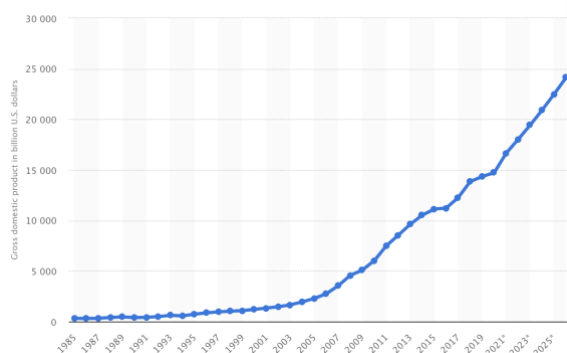


Figure 1: China's GDP between 1985 and 2025<sup>1</sup>

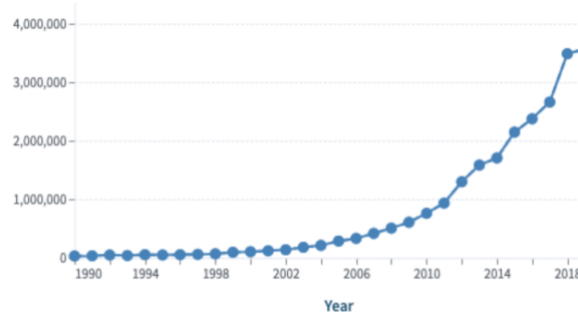


Figure 2: Chinese Granted Patents 1990-2020<sup>2</sup>

In this paper, we report insights from a field trip to three important regional innovation clusters in China, including Beijing, Shanghai and Shenzhen. We conduct an ethnographic study with 20 interviews to develop understanding of how key innovation system stakeholders perceive the importance of IP, their understanding of IP and how it can be used, in China. While each of the cities is distinctly different with regard to its innovation ecosystem, they all contribute largely to annually granted patents and are important political, economic and educational hubs within China. Looking into the number of accepted patent applications in China in 2019 underlines the strength of these three cities and importance towards the Chinese innovation system. Beijing and Shanghai are listed as individual cities, while Shenzhen is the capital of Guangdong province, which tops the list of regions for accepted patent application (Figure 3). While Beijing is widely known as China's capital, political centre and for its academic institutions, Shanghai is known for its economic role within China (Luo and Sun 2020). Shenzhen has recently attracted much attention for being China's innovation hot spot and home for numerous start-ups and high-tech firms (Motohashi 2018, Hu 2019). The three cities are

<sup>1</sup> Gross Domestic Product (GDP) of China between 1985-2025, URL:

<https://www.statista.com/statistics/263770/gross-domestic-product-gdp-of-china/>, accessed: 04.06.2021

<sup>2</sup> The annual Chinese Granted patents have been sourced from [www.lens.org](http://www.lens.org), accessed: 04.06.2021

often compared in academic literature regarding technological innovation, policies and the role of universities and other research institutions (Motohashi 2018, Si et al. 2020).

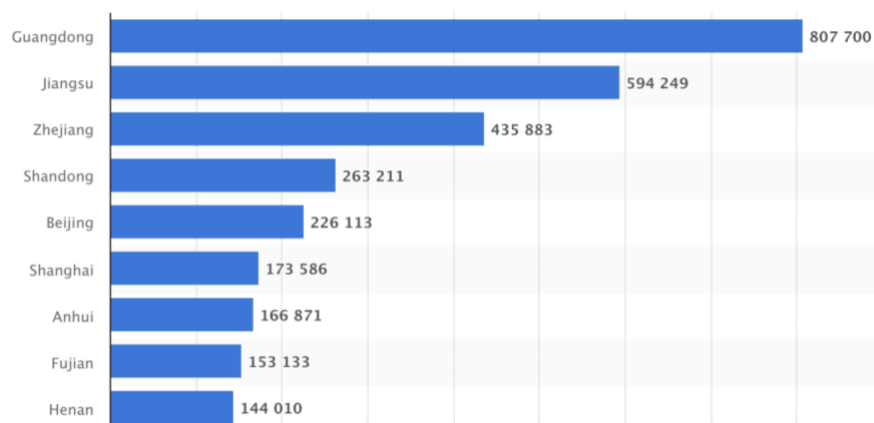


Figure 3: Number of patent applications in China 2019, by region<sup>3</sup>

The literature on innovation systems has developed strongly since seminal contributions from the early 2000s (e.g. Nelson 2002, Freeman 2002, Carlsson et al 2002). In more recent years, the development of the Chinese innovation system has been discussed in the literature (Zhao et al. 2015, Wu, Zhuo and Wu, 2017). That literature, amongst other topics, focuses on how the Chinese innovation system is transitioning (e.g. Liu and White 2001, Gu et al 2016), i.e. catching up (Sun 2002), associated policy making (Xiwei 2007), regional innovation sub-systems (Yang et al 2012) as well as links between different innovation system actors, such as universities (Motohashi and Yun 2007). After the introduction of a patent system into the Chinese innovation system in the early 1980 (Shuchun 1987) literature has followed the changes to the Chinese IPR systems, respectively patent systems (Zhuang 2013, Li and Zue 2010). Meanwhile, Chinese companies became the world's largest patent filers (Hu et al, 2017).

## 2. Methodology

In order to gain an understanding of the current perception of the importance, usage and value of IP by different actors in China's innovation system, this study employs an ethnography field research methodology (Robson and McCartan, 2016, Jones, 2014). We follow an immersive field research (Fig. 4), which is advantageous in understanding, observing and interacting with people in their natural settings, while allowing researchers to be out in the real world and witness the investigated phenomenon (Mason, 2002, Wood, 2007, Van de Ven and Poole, 2017).

Field research is often consisted of participant observation, interviews and document analysis (Richard Skogley and Sawyer, 1992, Gibbs, 2007). This study deploys semi-structured interviews, to collect information and notes on the innovation ecosystem of China from a variety of stakeholders (Guest,

<sup>3</sup> The number of patent applications in China 2019 by region has been sourced from Statista, URL: <https://www.statista.com/statistics/234255/accepted-patent-registrations-in-china-by-region/>, accessed: 04.06.2021

Namey and Mitchell, 2013, Cassell, 2015, Katz, 1983, Flick, 2009). We specifically follow an adapted semi-structured interview protocol with participant observation, given that one of the two independent observers on site is of Chinese origin. We visit 3 provinces in China that are considered to be key to the Chinese high-tech innovation system (Beijing, Shenzhen, Shanghai). We conduct 20 interviews in person with high-profile, key innovation system stakeholders from: (i) universities/technology transfer offices (TTOs), i.e. Beijing University, Tsinghua University, Harbin Institute of Technology, Chinese Academy of Sciences, Peking HSBC Business School, Shanghai Jiao Tong University); (ii) top-tier IP consulting firms; (iii) Chinese largest venture capital firms, (iv) government officials, (v) investors, and (vi) make-space members and entrepreneurs from start-ups.

For each interview, there are two independent observers onsite, who conduct the interview, and take field research notes (Jones, 2014). Then, the observers cross-validate the data afterwards, after each: (i) interview, (ii) stakeholder group, and (iii) innovation cluster is completed (Robson, 2011). This ensures that validity, reactivity and reliability are maintained (Katz, 1983). A third observer offsite reviews the information and checks the research notes from the interviews and the field. The list of coded interviewees can be found in Appendix A.

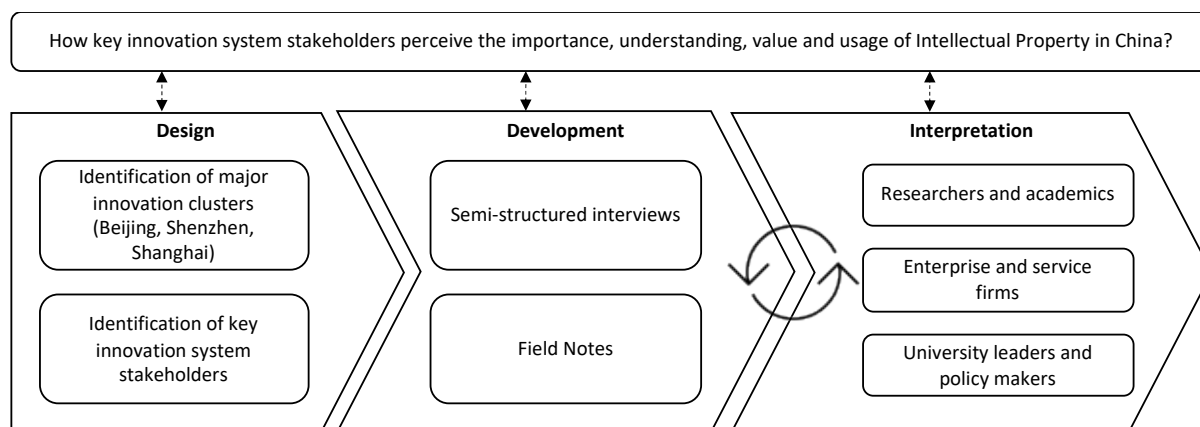


Figure 4 Ethnography field research method followed in this study

### 3. Results

Amongst others, the field trip to three leading regional innovation systems in China included visits to governmental facilities, production plants, company offices, start-up incubators, university labs, etc. This section summarises some key observations from interviews with three innovation stakeholder groups: (1) researchers and academics, (2) enterprises and service firms and (3) university leaders and policy makers.

#### 3.1 Researchers and Academics

University researchers and academics play a paramount role in the innovation ecosystem in China, because they are both a big generator of new IP and a group of potential start-up entrepreneurs. The

authors interviewed academics from five different research institutes and found interesting results regarding the use and perception of IP.

Leading universities, as well as accelerators and makerspaces typically provide occasional IP expert talks, while some even run dedicated IP education modules bringing in Western academics but also industrial practitioners. While most universities still do not have dedicated modules to teach IP, they are aware that this topic is of growing importance. Few universities are even establishing graduate IP programs, such as in collaboration with WIPO.

One common response from the academic interviewees was that, despite these IP trainings, researchers were still craving for more education and professional guidance on certain IP matters. For example, the technology of synthetic biology is an emerging and promising technology, but heavily based on the discoveries of traditional biology. Since synthetic biologists use traditional biology findings to create and design new products, it is very difficult to prove how novel the new discoveries are to the patent office. Therefore, it is clear that education is needed for both the applicants to explain better and for the patent officers to understand the novelty of new emerging technologies. It might be noted that the authors gave a talk to graduate and postgraduate students from the Chinese Academy of Sciences during the field trip. In contrary to the expectations, it appeared that those students lacked an even basic understanding of IP. Moreover, although most universities in China are equipped with technology transfer offices, the quality of IP law service provided by these offices are considered to be subpar by the researchers. Therefore, spinoff companies were often hiring external IP lawyers to file and protect IP, which can be very costly.

Despite these IP challenges for Chinese academic researchers, they also witnessed the ongoing IP system reform in China. For example, there is clear trend of universities giving more ownership of IP to the inventors rather than keeping it for themselves. They support the inventors during both the IP application process and the spin-off setup process. The amount of subsidies given by the universities to support researchers applying for patents increased during the last decade. And recently, the universities started giving inventors priorities to obtain exclusive licenses at the beginning of the spin-off process. After the start-ups getting enough investment, they would then get a chance to buy off the patents from the universities.

### 3.2 Enterprise and service firms

This innovation system stakeholder group includes product manufacturing companies from high-tech and low-tech sectors, but also service firms, particularly IP service firms, such as patent and trademark attorney companies as well as start-up incubators and leading venture capital funds.

Interviewing companies we came to understand that even smaller, but high-tech firms nowadays seem to have a decent understanding of IP and how it can be used strategically. Speaking to a synthetic biology company in Beijing we learnt that even smaller firms seem to have a good awareness and understanding of IP. Some of them even appear to have a dedicated (at least part-time) IP manager. When visiting a rather traditional, but global engineering business in the outskirts of Shanghai we were surprised by the IP awareness of the production manager. When showing us around the factory,

without prompting him, he proudly showed and explained to us the two patented technologies that the company had developed.

When speaking to representatives from one of Beijing's largest patent law firm we learnt that the firm employs an own team of about 30 software developers, including 5 AI experts. During the time of our visit that team was close to finishing the development of a machine learning based software tool for trademark searching. The company itself also has invested in other companies that develop technologies that appear relevant for the future of IP management, such as automated patent translations and AI powered patent search engines. Given that a number of universities have not got (yet) so skilled technology transfer offices (TTO), the patent law firm offers also services that would typically be taken care of by these TTOs. So the patent firm does not only draft patent applications for universities but also provides advise in which countries they should apply for patents. It was also mentioned that the patent law firm operates an own department that offers IP services for foreign firms that want to enter the Chinese market.

When interviewing executives from three leading venture capital firms in the Shenzhen region we did not have to prompt them much about IP, rather they seemed to have a good awareness of IP. All three firms clearly highlighted the importance of IP and the founding team as key investment criteria. Discussions with executives of leading venture capital firms mostly revealed that in the recent 10 years they have learnt that IP is key for their investments. While some early investments had failed due to IP issues in the late 1990s / early 2000s because founders did not pay sufficient attention to IP, in the last 10 years the IP awareness and understanding has increased so that those failures had not occurred in the last few year. Most notably, nowadays VC firms tend conduct IP due diligences when considering investments, although typically using external providers. They also emphasised the importance to do a detailed IP clearance before an IPO. It seems however that investors (yet) pay less attention to and go systematically about nurturing IP development after their investment so they can leverage IP to maximise the company's value towards the exit. VC executives also discussed situations where certain IP ownership constellation would prevent them from investing, such as when the IP derives from the former employer of the founder. Investors also spoke about the challenges and options to compensate universities for the IP which an academic founder of a university spin-out developed while being a researcher. Investors also reported changing governmental rules regarding subsidiaries for patent filings and enforcement.

One conclusion we derived from conversations with different enterprise actors, including from university incubators seems to be the importance and size of the Chinese market, which means that a large number of companies do not have to think about international IP rights. For companies and university spin-outs alike, China appears to be such a large market that they typically focus their patenting activities only on China, particularly at the beginning of the venture journey. After having succeeded in China, other Asian countries are often the preferred markets for an initial international expansion, before companies attempt to internationalize to the European or American markets.

### 3.3 University leaders and policy makers

The role of government and policy maker is of vital importance to how IP is perceived and used in the Chinese innovation ecosystem. And since most of the top universities are state owned, these



universities' IP policy have strong influence as well. The authors interviewed five university policy makers to learn about the IP policies of these top Chinese universities. Firstly, all five universities visited during this fieldtrip had already established technology transfer offices. And the consensus is that a well-managed technology transfer office is key for the universities to promote the protection and usage of IP, and ultimately the commercialization of the technologies generated from the universities' work. Additionally, these universities have subsidy schemes to support researchers for applying and maintaining patents around the world. The schemes are financially supported by themselves and the national-level government agencies. Although all five universities encourage technology commercialization through the technology transfer office, the supporting policies vary. Some universities have having strict rules of owning at least 20% of all the spin-offs that co-own IP with the university or license from the university. They would then give over half of these shares back to the IP inventors. On the other hand, some universities believe having a smaller stake or, sometimes none, in the spin-offs could help create a healthier and more organic innovation system for the universities. We also had an interesting response from a university professor, who worked as the executive of an international banking organisation, about China's approach towards IP. He believed that China, like all the other developing countries, should have a different and more open approach towards IP than the more developed western countries.

The authors also interviewed four high ranking government officials, including one deputy mayor, one head of city IP office and two executives of a state-owned IP platform company. During the interviews with two local government officials, the IP system in Shanghai was discussed. The IP office in Shanghai was formed in 1980s. In order to encourage technology transfer and increased usage of IP, the Shanghai government built the Zhangjiang District in early 2000s. A large number of highly innovative companies and most of the top universities were invited to setup branches in this district, so that they can work together to commercialize the most cutting-edge technologies. The government also invited IP law firms and impact-oriented investment funds to setup offices and provide service. Additionally, the government is also working with WIPO to set up more IP related degrees and training courses in universities in Shanghai. Moreover, with the help of the central IP office, a national IP operation platform company was formed in Shanghai. The platform was built with four purposes. First of all, the company utilizes the IP information collected around the country to provide a platform for local IP trading and promote collaboration between academia and industry. Secondly, the company provides services for international IP transactions, including both importing and exporting intellectual properties. Thirdly, the company has formed an impact-oriented fund that provides financing for the IP related operations for target high-tech industries and universities. Lastly, the platform facilitates the trading of IPR, with various connected service offerings, e.g. connecting investors with IP holders to form new companies.

## 4. Conclusion

During the field trip the authors had a chance to conduct interviews with representatives from three major innovation system stakeholders. Overall, the interviews revealed a high level of IP awareness. Whether academics, governmental representatives, entrepreneurs or venture capital executives, all interviewees did not need to be prompted much to understand the importance of the IP in the Chinese



innovation system. This awareness was even visible “on the ground” during a visit and tour of a rather traditional, but global manufacturing production facility outside of Shanghai.

Governmental rules for subsidizing patent applications seems to be changing in China in order to move from quantity to quality, ie to produce more high value patents. While at least the leading universities seem to have established technology transfer offices, different observations indicate that these TTOs still need to improve their service offerings, as some of the typical TTO services appear to be offered by IP law firms. While at least leading universities offer occasional IP guest lectures, they still are in the process of installing IP modules in their formal curricula.

Also, while investors seem to understand the importance of IP when making investment decisions, they might still have to develop a better understanding of how IP can be nurtured to maximise value eg towards an IPO or exit. Having said this, the same might still be true for a number of Western VC firms.

Overall, one might however conclude that one can be positively surprised by the speed of which Chinese innovation system actors are becoming increasingly IP savvy. At the same time, we also heard multiple times that China’s large market size makes it less attractive to consider international IP strategies in early stages of a business. After succeeding in China, companies tend to prefer expanding into other Asian markets first, before venturing into Europe or the US.

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## Appendix

### Appendix A: List of coded interviewees

<b>ID</b>	<b>Function of interviewee</b>	<b>Organisational type</b>
1	Head of TTO	University 1 - Incubator
2	Managing Partner	IP Law Firm
3	Associate Lawyer	IP Law Firm
4	University Professor	University 2- Department of Economics
5	University Professor	University 1
6	University Lecturer	University 1
7	University Professor	University 2 - Business School
8	VP, Deputy CEO	Synthetic Biology Firm
9	Head of IP	Synthetic Biology Firm
10	CEO	Private Equity 1
11	Researcher/ Assistant to CEO	Private Equity 1
12	Executive partner and Co-founder	Private Equity 2
13	Director of Strategy and Research	Private Equity 2
14	Director of VC stage investment	Private Equity 2
15	Investment Director	Private Equity 3
16	Head of Law Department	Private Equity 3
17	Vice-President	University 3
18	University Professor	University 3
19	University Lecturer	University 3
20	Head of TTO	University 3
21	Co-founder	Maker Space
22	Research Director	University/Research Institute 4
23	Researcher	University/Research Institute 4
24	Head of Production	Bridge Cable Factory
25	Deputy Mayor	Government
26	Head of IP Department	Government
27	President	IP Service Platform (State-owned)
28	Deputy General	IP Service Platform (State-owned)
29	University Professor	University 5
30	University Professor	University 5