Analysis of China’s Industrial Policies: The Case of the Infocommunications Sector

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It is not easy to characterize China’s economic system with the standard terms of mainstream economic science. Terms like “state capitalism” or “developmental state” are misleading; they overestimate the role of government and underestimate the role of the market in the development of the Chinese economy. I have selected the infocommunications sector as a case study for two reasons: Although development started relatively late around 2005, in just ten years, China became the world leader in such important digital services like e-commerce or online payment. The fast development was based on a unique combination of active government, fierce market competition, and innovative private sector. In analyzing the lessons from experience, I want to separate the contributions of different factors to the sector’s development. I will prove that the government’s strategic foresight and the business-friendly regulatory approach to the emerging technologies were very important, but the marketing of innovative products by the large Internet companies and the fierce competition between them played a significant role as well. Besides the past development, I will also present the major features of ongoing government programs, like “Internet+” and “Artificial Intelligence Program”.

Keywords: industrial policy, China, digital economy

Overview of China’s Digital Economy

International Comparison

International comparison of China’s digital economy is important from two aspects:

- They demonstrate the very fast development and the catching up to the developed world (US, Japan, EU).
- They defy the exaggerated statements, such as “China is leading the world in digital services”.

The size of China’s digital economy is huge, but similarly to other sectors, there are big differences between urban and rural areas. In 2018, the usage of the Internet in the rural areas was 26.7%, about one-third of that in urban areas (CNNIC, 2018).

At the end of 2018, the total number of Internet users was 828 million more threefold increase compared to 10 years ago. The 59.6% of the population regularly use internet services, which is a rather high share, but lags behind the developed countries. According to the latest available statistics, the total number of users is bigger than that of the EU and the US together. It provides opportunity for Chinese companies to enjoy scale advantages.
Connectivity is only one of the main drivers of the digital economy. There are other factors like consumer and business usage, the availability of digital skills, the supply of digital public services, the spending on research and development, which are equally important. The EU Commission uses the Digital Economy and Society Index (DESI), which is a composite index that summarises the above indicators on Europe’s digital performance and tracks the evolution of EU member states in digital competitiveness. The EU also regularly commissions respected consultants to prepare a so-called I-DESI study, comparing the EU with other countries, including China.

The following figure summarises the most important results of the I-DESI study from 2018.
As could be expected, China is still lagging behind the developed countries, but the difference between them is decreasing rather fast. More importantly, if we compare China’s score with that of EU bottom four Member States average score, the difference is minimal. Taking into account that GDP per capita in these EU bottoms four Member States is 20% higher than in China, the results of the last three years are indeed very positive.

Table 1
Comparison of the Different Dimensions of I-DESI Scores in 2016

| Dimensions of I-DESI scores          | China  | EU average |
|--------------------------------------|--------|------------|
| Connectivity                        | 45.9%  | 62.9%      |
| Human capital                        | 40.5%  | 58.0%      |
| Citizen internet use                 | 45.3%  | 59.7%      |
| Business technology integration      | 40.7%  | 51.3%      |
| Digital public services              | 58.6%  | 63.1%      |
| Normalized performance score         | 45.3%  | 58.9%      |

Note. Source: I-DESI (2018).

Comparing the different dimensions of I-DESI performance scores, China reached a relatively advanced level in digital public services and business technology integration, but lagged in connectivity and human capital.

China’s Mobile Internet Eco-system

The most developed segment of China’s digital economy is the mobile internet. Nearly all of the Internet users use mobile access, a significant part of them uses it exclusively.

Figure 3. Number of mobile Internet users. Source: CNNIC (2018, p. 23).

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1 In this chapter, I used the following sources: Ma, Meng, Wang, & Yan (2017); Greeven & Wei (2017).
In the last fifteen years, this eco-system was a major driver of the development of China’s digital economy. It has “Chinese characteristics” for two reasons:

- There is no single country in the world that has a similar complete system with so many well-developed segments in it. We will show that the critical segments of this eco-system are dominated by domestic companies, either mainly privately-owned companies (handsets, telecom equipment, mobile-oriented applications, and information services) or state-owned enterprises (telecom service providers).

- In this eco-system, the special hybrid character of the Chinese economic system appears in an optimal form, the active government, the market-oriented private enterprises, the foreign technology suppliers cooperate quite effectively.

  - In the development planning, the government always emphasized the importance of different infrastructures; mobile networks was one among them. Mobile networks need state-owned frequency to operate, the government always allocated the frequencies in due time and flexible format.

  - In the period between 1990 and 2010, the opening to the outside world was another important priority. The market entry of foreign high-tech firms like Ericsson, Motorola, or Alcatel was supported by generous rules, and the local competitors had no special advantage in procurement processes.
In the new market segments without traditions⁰ where no state-owned companies leftover from the pre-reform period, private companies had no limits to enter and grow. In certain developed locations (Shenzhen, Hangzhou) they were supported by the local governments as well.

Since the different segments had different development paths, it makes sense to analyze their development separately.

The so-called chips are key components of mobile handsets. Until 2017, the Chinese handset manufacturers were not able to develop and produce these sophisticated components. They had to rely on either US suppliers, mainly on Qualcomm, or for cheaper models on Taiwanese companies, like MediaTek. The dependence on foreign suppliers was risky, but the government understood, it cannot force the domestic companies to develop technically demanding products without the necessary competences. Using chips from foreign sources handset manufacturers were able to offer competitive products and reduce operating costs at the same time.

After 2010, the Chinese mobile handset manufacturers grew extremely fast, and by 2015, they dominated the Chinese market. One of the most important players is Xiaomi, which was founded as a private company in 2010 and already in 2014, became a market leader. Xiaomi followed the business strategy of Apple; they applied innovative marketing solutions like the exclusive online distribution channels or the support of a big and committed fan camp.

After 2010 Huawei, the biggest domestic telecom equipment manufacturer, also entered the handset market. In 2018 they had the largest market share not only in the whole Chinese handset market but in the premium segment as well. Huawei is the only Chinese handset manufacturer that uses his own chipsets. By 2017, after many years of research and development efforts, they were able to reach a position which is similar to global market leaders (Apple, Samsung).

The other segment, which since 2008, is dominated by domestic suppliers (Huawei, ZTE) is the telecom equipment market. This new situation is a big change compared to that from fifteen years ago when foreign companies, like Ericsson and Alcatel had the upper hand. The first mobile networks based on the so-called second-generation GSM standard were built around the turn of the century, and they were implemented by big European firms who owned patents needed for it. The leading Chinese companies Huawei and ZTE put big efforts into developing their products for the new third and fourth generation networks which, targeted data communications like mobile Internet. After fifteen years, during which they invested about 10% of their annual revenues into research and development, they were able to acquire patents not less in numbers than their competitors (Huawei, 2018).

The Chinese government did not provide any special subsidies for domestic equipment manufacturers. One of the most important contributions from the government side was the fast development of the high-education system. Since the turn of the century, the annual number of university graduates reached seven million a large share of them were highly skilled engineers. Chinese telecom equipment manufacturers were able to hire thousands of world level young talents. Today the average age of R&D Huawei and ZTE is below 30 years.

The telecom services market differs to the other segments since, until recently, the Chinese government restricted the market entry of both the foreign companies and the domestic private companies. In 2019 the

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⁰ Like online services or mobile applications.
provision of basic telecom services\(^3\) is limited to only three state-owned companies: China Mobile, China Telecom, and China Unicom. Despite the oligopolistic market structure and the state dominance of ownership, the Chinese telecom service market grew rather fast, and the profitability of the above three companies is also not lagging behind the international benchmarks. There are two reasons for these positive results.

- In the period between 1997 and 2002, all of the three companies were listed on the foreign stock exchanges. The privatization was linked to a complete corporate reorganization, enhancing the efficiency and the transparency of their operations. China Mobile’s introduction to the New York and the Hong Kong Stock Exchange at the end of 1997 offered the first opportunity for Western institutional investors “to buy into the China Miracle”. This Initial Public Offering (IPO) raised 4.2 billion USD which could be used for financing the network construction. The IPOs of the other two companies were also quite successful in raising new financing for investments. The reorganization of telecom companies was a gradual process. In the beginning, only the operations of the most developed Eastern provinces were incorporated into the listed companies, and the other regions remained at the 100% government-owned parent company. After some years, the listed companies already covered all regions.

- There was a fierce competition between the three state-owned companies. Although their market shares were different, the demand from the customer side increased fast, all of the three companies were able to reach double-digit growth. The government, as a regulator pursued a rather laisse-fair approach; therefore, the companies were able to use flexible price packages. The price competition provided a strong stimulus for market development. Similarly to other developing countries, mobile voice and data services became the substitute for landline services, as a consequence, the mobile network quickly achieved full nation-wide coverage.

Since the state dominates the telecom services sector, the sophisticated and demanding regulatory tasks could be managed much more easily. For instance, the operations of mobile networks need a radio frequency, which is a government asset. In developed countries, these frequencies are allocated by auctions, providing huge revenues for the government budget. In China, this allocation is implemented by administrative orders, taking into account the size and the technology of the mobile operators. The companies were not forced to pay huge frequency fees, which reduced their cost level. The timing of the allocation was also more flexible than in other countries. The smaller companies like China Telecom and China Unicom received their frequencies earlier than the market leader China Mobile; therefore, they had more time to prepare for the start of the commercial operations.

By the end of 2013, all elements of the mobile eco-system were ready for uptake. The frequencies for the fourth-generation mobile network\(^4\) were already allocated to the service companies; high-quality smartphones were available both from domestic (Huawei, Xiaomi) and foreign (Apple, Samsung) markets.

**Online Versus Traditional Services in China\(^5\)**

In China, underdeveloped traditional service sectors created leapfrog growth opportunities for online services. To understand this “leapfrogging”, we compared the development of the US and Chinese online sectors.

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\(^3\) Fixed voice and data services, mobile voice and data services.

\(^4\) 4G services are optimized for the mobile internet usage.

\(^5\) Useful sources to this point are: McKinsey Global Institute (2017); Boston Consulting Group (2017).
Table 2
Comparison of the Development of US and Chinese Online Sectors

| Country  | Development path     | Features                                                                 |
|----------|----------------------|--------------------------------------------------------------------------|
| US       | Incremental upgrading | Limited room for development given maturity of traditional industries,  |
|          |                      | consumer habits well established                                          |
|          |                      | Incremental upgrades on top of existing foundations                      |
| China    | Leapfrogging overtake | Market maturity is still low, several underserved markets                |
|          |                      | Digital platforms address the weak points of the markets, even became the |
|          |                      | dominant force in some market segments                                   |

Note. Source: Boston Consulting Group (2017, p. 27).

If we also compare the revenue structure of the above two countries, we can easily identify those online sectors which were underserved by the traditional players.

Table 3
Comparison of Online Revenue Structure in 2016

| Online service                  | China | USA |
|---------------------------------|-------|-----|
| Electronic commerce            | 44%   | 27% |
| Social media instant messaging | 23%   | 23% |
| Online finance (payment, lending, other) | 12%   | 5%  |
| Others                          | 21%   | 45% |

Note. Source: Boston Consulting Group (2017, p. 28).

Chinese internet firms could address those three consumer service industries, where the dominating state-owned enterprises (SOEs) were not able to meet the fast-growing demand and did not pay attention to the innovation of new business models.

- In the retail trade sector, the state-owned retail chains were not able to develop nation-wide brands and neglected the imports and the products of small and medium-sized private enterprises.
- In the financial services industry, the four market-leading state-owned banks neglected the online payment and wealth management services, and they were also reluctant to provide loans to the privately-owned SME companies.
- In the telecom services industry, the very profitable, but slow-moving three state-owned companies neglected the instant message and video streaming services.

It would be an exaggeration to say that the market distortions were the main reason for the fast development of the Chinese online sector. Market distortions provided room for the privately-owned domestic companies to enter these markets, but they had to innovate, to apply new business models, to use this opportunity. Alibaba, the leading e-commerce company and Tencent, the leading social media company, implemented different solutions:

- Alibaba’s e-commerce platform Taobao had a history of ten years, but with the availability of the third and fourth generation mobile services, the mobile version of Taobao was introduced as well. The majority of Chinese consumers prefer mobile internet compared to the slow, expensive, and complicated fixed access. Therefore, the mobile Taobao was immediately a great success.
- Besides Taobao, which is an online market place for smaller, mainly domestic brands, Alibaba introduced Tmall, a new platform designed to support foreign and domestic premium brands as well.
- Alibaba’s most successful innovation was the introduction of AliPay, a QR code-based online payment service that was optimized for mobile handset access. This application was not a technological break-through...
since QR code-based systems were well-known for many years. AliPay is a popular service because it is simple, easy to use on mobile terminals. AliPay was a preferred choice for the small merchants too because the bank cards issued by the state-owned banks are expensive and therefore the usage of them is rather limited.

The other leading online company Tencent followed a completely different business development path from Alibaba:

- Before 2012, Tencent’s main product was a PC-based, free instant messaging service called QQ. Although in 2004, the company was listed on the Hong Kong Stock Exchange, till 2011, Tencent was only one among the many Chinese Internet Companies. This year Tencent launched a social media application, which was a real break-through and, in some years, completely revolutionized the Chinese Internet market. The application called WeChat is specially designed for mobile usage and has many different functions and services. WeChat dominates the social media market since nearly every Chinese adult has an account and uses it regularly.

- WeChatPay is the online payment function of WeChat. It uses the same simple QR code technology like AliPay. They have nearly the same market share.

Thanks to the innovative marketing efforts of the service providers and the flexibility of the targeted consumers the adoption rate of the three main online services was much faster in China than in the US.

Table 4

| Application                  | China               | USA                 |
|------------------------------|---------------------|---------------------|
| Electronic commerce          | Taobao 2003-2011, 9 years | Amazon 1996-2008, 14 years |
| Online payment               | AliPay 2012-2016, 4 years | ApplePay 2014-     |
| Social media instant messaging| WeChat 2012-2015, 3 years | WhatsApp 2008-   |

Note. Source: Boston Consulting Group (2017, p. 15).

The government’s role in promoting the development of online markets was quite unexpected. According to the conventional view on the state-dominated Chinese economy, the government usually protects the interests of state-owned enterprises and does not allow private enterprises to grab market share from them. The development of online markets refutes this view. In 2018 the privately-owned e-commerce companies had a 19.8% share of total trade retail because the traditional state-owned retail chains have difficulties in competing with them. The state-owned retail bank’s online payment service has negligible market-share compared to that of AliPay and WeChatPay. The voice services using the WeChat platform replaced the traditional voice service of telecom companies causing huge revenue losses for them.

To understand the logic behind the business-friendly approach of the government, we have to recall that the Chinese government’s main priority is economic development and not the protection of certain interest groups. They have understood that online markets have huge development potential, but the traditional state-owned companies are not able to use this opportunity.

We have already mentioned that the launch of AliPay in 2011 was a major break-through in the development of Chinese online markets. AliPay had some predecessors used by Alibaba since 2003. The flexible regulation of the online payment market by the government enabled the gradual development of this system. As an emerging technology, the QR-based services also had five years of so-called regulatory holiday before the government’s technical standards were released.
In mobile payments, government policy left space for innovators to experiment

Selected examples

|                          | 2000 | 2005 | 2010 | 2015 |
|--------------------------|------|------|------|------|
| Money-transfer cap       |      | 2005 | 11 years | 2016 |
| Alipay’s unlimited online money-transfer service (from debit card to Alipay account) |      |      |      |      |
| Online money-transfer cap imposed by the government |      |      |      |      |
| Customer protection (escrow and goods claims) | 2005 | 9 years | 2014 |
| Alipay’s launch of escrow services |      |      |      |      |
| E-commerce requirements for consumer-goods claims |      |      |      |      |
| Online payment           | 2003 | 7 years | 2010 |
| Taobao’s first online payment transaction |      |      |      |      |
| Payment business license to third party passed by the government |      |      |      |      |
| Barcode-based mobile payment | 2011 | 2016 | 5 years |
| Alipay’s launch of barcode-based payment services |      |      |      |      |
| Barcode payment released by the government |      |      |      |      |
| Online payment transactions $ billion | <1 | 2 | 149 | 1,811 |

*Figure 5. Overview of the regulation of Alibaba’s online payment services. Source: McKinsey Global Institute (2017).*

**Chinese Government Programs for the Development of the Digital Economy**

**Internet+ Program**

Before 2015, the Chinese government had no comprehensive national plan to develop its digital economy. Although by that time, an eco-system was already formed and its take-off has already been started, but this was a joint effort of the mainly privately-owned business sector and the different state agencies. As I have proved above, different factors contributed to this result: the catch-up effect, the innovative marketing of companies involved, and finally, the business-friendly regulatory approach of the government. Except for the first, the other two factors are not typical features of “state-dominated economies”.

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6 The so-called Great Firewall is a heavy-handed intervention into the operations of online markets. Facebook, Twitter, and Google are banned in China, and of course it provides more room for development of local companies. This topic was outside of the scope of our research.
However, in 2015, there was already a need for more involvement from the government side, a need for more coordination between market players and government agencies. The Internet+ program was issued as a government order in May 2015 (国发, 2015). It is interesting to note that the first person who publicly initiated this program was Pony Ma, the founder and the CEO of Tencent Holding (Ma, Meng, Wang & Yan, 2017).

Internet+ is not a cross-sectoral plan, it is a strategic framework, and it provides guidelines for both the government and the business sectors. The program builds three major principles:

- open Internet as a platform for sharing of different resources (technology, human resources, distribution channels);
- integration of internet-based technologies with the technologies of the traditional manufacturing sectors;
- leapfrogging in research and development, instead of the gradual approach, complete replacement of certain outmoded technologies with new online-based ones.

Concerning innovation, there are three major priorities in the program:

- promoting the innovation of the corporate sector;
- strengthening the societal base of innovation, supporting mass entrepreneurship;
- building an open, cooperative innovation where the participants work together and share their results.

The quantitative targets are completely missing from this program. Its implementation has to be realized in two steps:

- By 2018 the digital economy has to be the main driving force of the whole economy;
- By 2025 the complete digital eco-system has to be finalized.

Ten priority sectors were identified: manufacturing, agriculture, energy, finance, public services, logistics, electronic commerce, transport, environment, artificial intelligence.

In the implementation part of the program, there are four main areas:

- strengthening foundations involves development of:
  - telecommunications networks;
  - applications specialized on the needs of different sector;
  - key technologies like chips;
  - tools enhancing network security.
- promoting innovation involves:
  - building of cross-sectoral innovation networks;
  - development of digital standards;
  - enhancing the protection of intellectual property;
  - tools supporting the sharing of the results of research and development.
- supportive regulatory environment involves:
  - fine-tuning of market regulation;
  - development of a special credit-system;
  - availability of open databases;
  - consolidation of the legal framework.
- promoting international cooperation involves:
  - development of applications targeted on markets;
  - government support of companies entering to global markets.
My overall evaluation is that Internet+ is a high quality, comprehensive government program. It has some similar features to the Digital Single Market program, which was developed and issued by the EU Commission (EU, 2014). Compared to other Chinese government strategic programs\(^7\) that are setting quantitative development targets and using state subsidies to realize them, the Internet+ program concentrates on coordination between different industries. It was issued in 2015 when the Chinese “internet fever” was at its peak; however, its targets and priorities are still quite realistic.

**Artificial Intelligence Program**

Artificial intelligence (AI) is a relatively new concept, but it quickly became a fashionable buzzword. According to the practical definition of McKinsey (2018), AI makes the machines capable of performing cognitive functions, we associate with human minds, such as perceiving, reasoning, learning, and problem-solving. Examples of technologies that enable AI to solve business problems are robotics and autonomous vehicles, computer vision, language, virtual agents, and machine learning. (p. 1)

If a country wants to be competitive in AI, four important pre-requisites are needed (Ventures, 2017, p. 3):

- Availability of large, labelled data sets: AI uses these large data sets as examples to teach its algorithms to optimize;
- Computational power: Huge data sets require significant computing power, in most of the cases specialized hardware;
- Special human expertise: ordinary engineers cannot use AI algorithms, experts are needed to “tune” AI to work for a given topic and data set;
- Special regulatory environment like data standards or security rules and well-defined areas or topics where AI is applied.

The international analysts are divided on whether China will be capable of playing a leading role in AI development. The optimists refer to the large data sets that are created by the usage of online services (Ventures, 2017). The moderates point to relatively low technical level of indigenous hardware industry.\(^8\)

With the publication of Artificial Intelligence Program\(^9\), the government had two goals in mind:

- to provide a well-defined and transparent regulatory environment for AI;
- to support the AI-related research and development activities.

This document compared to the Internet+ program not limited to general principles, it sets many quantitative development targets for the coming fifteen years:

- By 2020, the international cutting edge will be reached, all the necessary standards will be approved, and a complete AI-based industrial eco-system will be established. The production value of direct AI applications will be 100 billion RMB, together with related applications will be 1,000 billion RMB.
- By 2025, breakthroughs in some priority areas will be achieved; the legal and regulatory framework will be completed. The production value of direct AI applications will be 400 billion RMB, together with related applications will be 1,500 billion RMB.
- By 2035, China will be the world leader in all main areas of AI with a comprehensive and mature scientific and technological system.

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\(^7\) Like the famous Made in China 2025 analysed in Mercator (2016).

\(^8\) AI needs special chip which is not available in China.

\(^9\) 由于[2017]. Since official English translation was not published, below I provide a short summary of the program.
We can have doubts about whether technological forecasts for fifteen years make any sense at this early stage of AI development. On the other hand, we have to acknowledge the ambitions and the commitment of the Chinese government to provide guidelines for the scientific community and corporate sector to enter this broad area of research and business development. Compared to China, the EU Commission has dedicated only a small amount of money for this purpose and until now, was not able to elaborate a detailed policy paper on AI development (Mercator Institute, 2018).

Conclusions

The infocommunications industry is a special segment of the Chinese economic system. From the technological point of view, it is much closer to the international cutting-edge than any other Chinese industry. The research and development activities of the market leaders (mainly privately-owned companies) are on a very high professional level, they have many joint projects, both with foreign industrial partners and research institutes. The government policy avoided the heavy-handed interventions into the operations of the market; on the contrary, they tried to provide a business-friendly regulatory environment for the development of the industry.

The history of development planning in China provides some lessons for the present decision-makers. There were many examples of failed government programs where ministries tried to force indigenous research and relied on state-owned monopolies. In the eighties and nineties, all attempts to create a domestic car industry failed; the government had no other choice than to invite foreign car companies to set up joint ventures. The domestic airplane industry, despite the heavy state subsidies, was not able to deliver the expected product for many years. In the renewable energy sector, the wide-spread use of state subsidies created overcapacities instead of technological break-throughs.

In the last two years, industrial policy has been the subject of several scientific debates in China (Lin, Zhang, Wang & Kou, 2018). Infocommunications industry has demonstrated that a development path that relies on privately-owned companies, intense market competition, foreign cooperation, and business-friendly government regulation can be much more successful than the traditional state-dominated approaches.

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