Università degli Studi di Ferrara

DIPARTIMENTO DI ECONOMIA E MANAGEMENT

LM Business | FF.1

Business, Markets, and Competition

LM Econ. man. and pol. for global challenges | AA 2019/2020

7 CFU | SSD SECS-P/06

Lecturers: GIORGIO PRODI, FEDERICO FRATTINI

Science, Technology and Innovation (STI) Policy in China

Reference materials

1. Naughton B, 2018, *The Chinese Economy* (second edition). MIT Press: 363–394
2. Fu X et al., 2016, Technological innovation policy in China: the lessons and the necessary changes ahead. *Economic Change and Restructuring* 49(2): 1–19
3. Abramovitz M, 1986, Catching Up, Forging Ahead, and Falling Behind. *The Journal of Economic History* 46(2): 385–406
4. Park K, Lee K, 2006, Linking the technological regime to the technological catch-up: analyzing Korea and Taiwan using the US patent data. *Industrial and Corporate Change* 15(4): 715–753
5. Thun E, 2014, The Globalization of Production. In Ravenhill J, ed, *Global Political Economy*, Oxford University Press: 283–304
6. Schumpeter JA, 1912, *The Theory of Economic Development*. Harvard University Press

What is “**technology**”?

Technology does not enter directly as an argument in the aggregate production function; it is the background, and can be thought of a set of blueprints that determine what combinations of production factors is possible.

– Naughton B, 2018: **364**

And what is “innovation”?

Innovations are new ways to combine the production factors one another.

– Schumpeter JA, 1912

Why are technology
so **relevant** to China?

Why is especially relevant to **catching up** with more developed countries?

[...] *Economies can grow out of low-income status in a straightforward way, but after an economy reaches middle-income status, growth requires a different mix of less common skills, including the ability to innovate and compete in market segments that demand high quality and constant innovation.*

– Naughton B, 2018: **363**

What is the **challenge**?

[...] *developing countries face enormous difficulties exploiting* [the advantages of lagging behind]. *It takes time and skills to identify technologies that are available and appropriate* [...]. *Moreover, companies in developing countries increasingly* [...] *fence off their intellectual property rights.*

– Naughton B, 2018: **366**

Escaping the so-called “middle-income trap”

Have you ever flown on Chinese-made **aircrafts**?

Have you ever considered to buy a Chinese-made **car**?

In the auto industry, the dominant foreign firms were all in joint ventures with domestic state-owned companies, but were thought to have done little to help their domestic partners to upgrade technologically.

– Naughton B, 2018: **379**

Do you know where is your **laptop** assembled?

[...] *after 2001, virtually the entire assembly of laptops moved over to China.* [...] *to this day, laptops assembled in China by Taiwan firms in China account for more than 90% of world laptop production. Nobody else can compete.*

– Naughton B, 2018: **376**

Is your **smartphone**
one designed in China?

Which is the company offering the **cutting edge mobile** connecting infrastructure (5G)?

[...] *the most technologically sophisticated firm was the Huawei Company, perhaps the most innovative company in China today and the global company that has been, in most years, the largest recipient of international patents.*

– Naughton B, 2018: **377**

Catching up with industrialization is faster, because absorption and learning are faster, when it follows on developing shorter cycle-time technologies (and the ICT technologies are of this very kind).

– Park K, Lee K, 2006

Which was the cutting edge technology **available** in China during the ‘50s?

The Soviet Union was China's technology patron during the '50s. The Soviet Union transferred not only the technologies, [...] *but also the key institutions that shape incentives to adopt technologies.*

– Naughton B, 2018, **369**

How could China **climb** the technology ladder **so fast**?

A **mix** of drivers and initiatives was at work, which includes...

Science, Technology and Innovation (STI) Policy in China

Summary of the STI stages

1950–1965	Soviet Union's patronage	
1965–1978	Autarky (reverse engineering)	
1978–1985	Centralized purchase of foreign technologies	+ Broadening the domestic R&D base
1985–1992	Conditional Foreign Direct Investments	+ Encouraging spin-offs of domestic R&D
1992–2000	Opening up to Foreign Direct Investments	+ Integrating into Global Networks
2000–2006	Supporting domestic entrepreneurship	
2006–today	"indigenous innovation" for industrial development	

– Naughton, 2018: 369–370; 373–383 (periods are approximated for summary purposes)

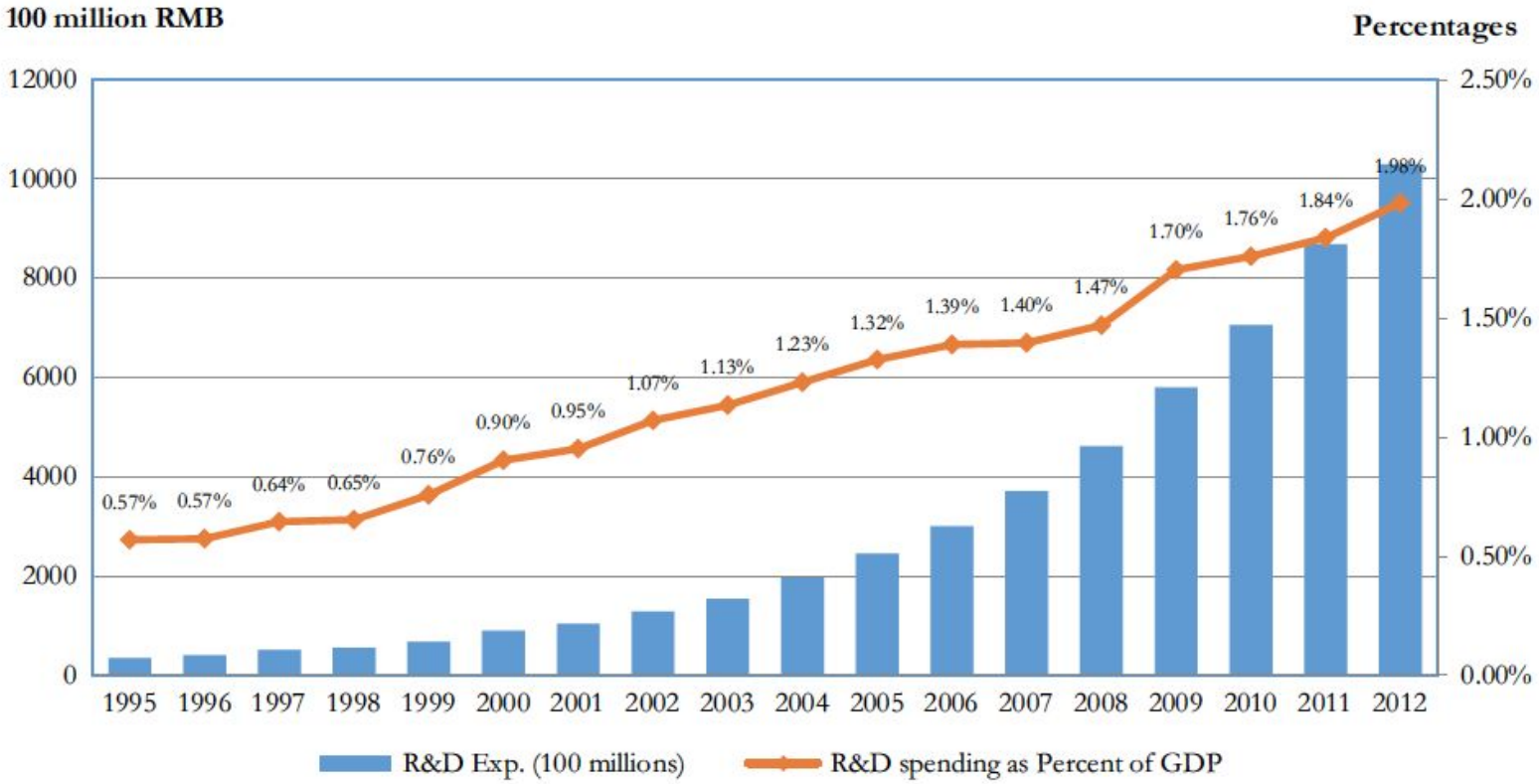
The Medium-Long Range Plan for Science and Technology (2006)

STI policy in China before 2006

Key STI initiatives before 2006

1982	Key Technologies R&D Program	focus on priority areas
1986	Spark Program	focus on upgrading SMEs' technologies
1987	High-Tech R&D Program	diffusion of knowledge to fill the gap with more advanced countries
1988	Torch Program	industrial and technological parks to support the development of high-tech industries
1993	Innovation Fund for Technology-based SMEs	focus on startups
1997	National Key Basic Research Program	overall restructuring of the national STI policy
		– Fu X et al., 2016

R&D spending



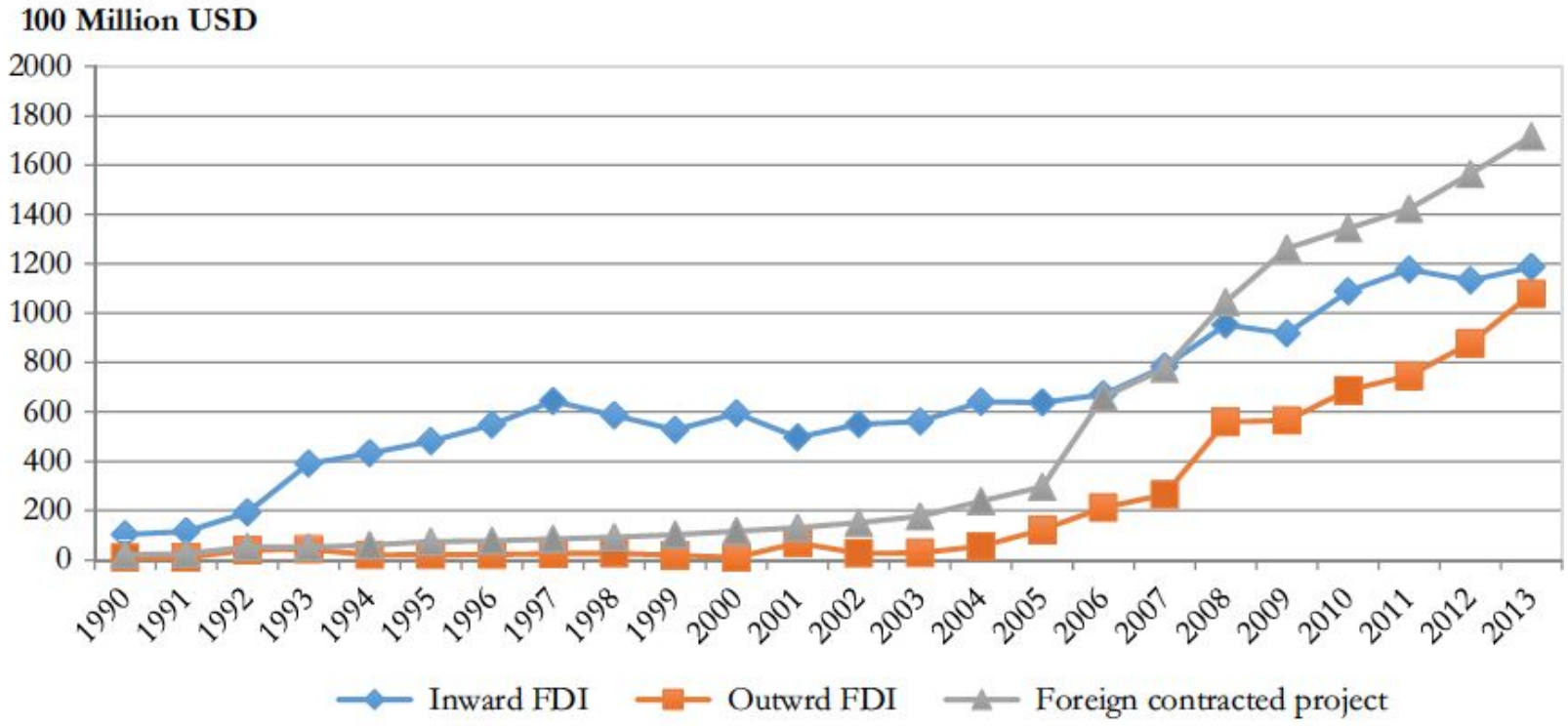
R&D expenditure in RMB and as percentage of GDP, 1995–2012
– Fu et al., 2016: **Fig. 3**

Technology companies

(e.g. Lenovo)

Foreign Direct Investments

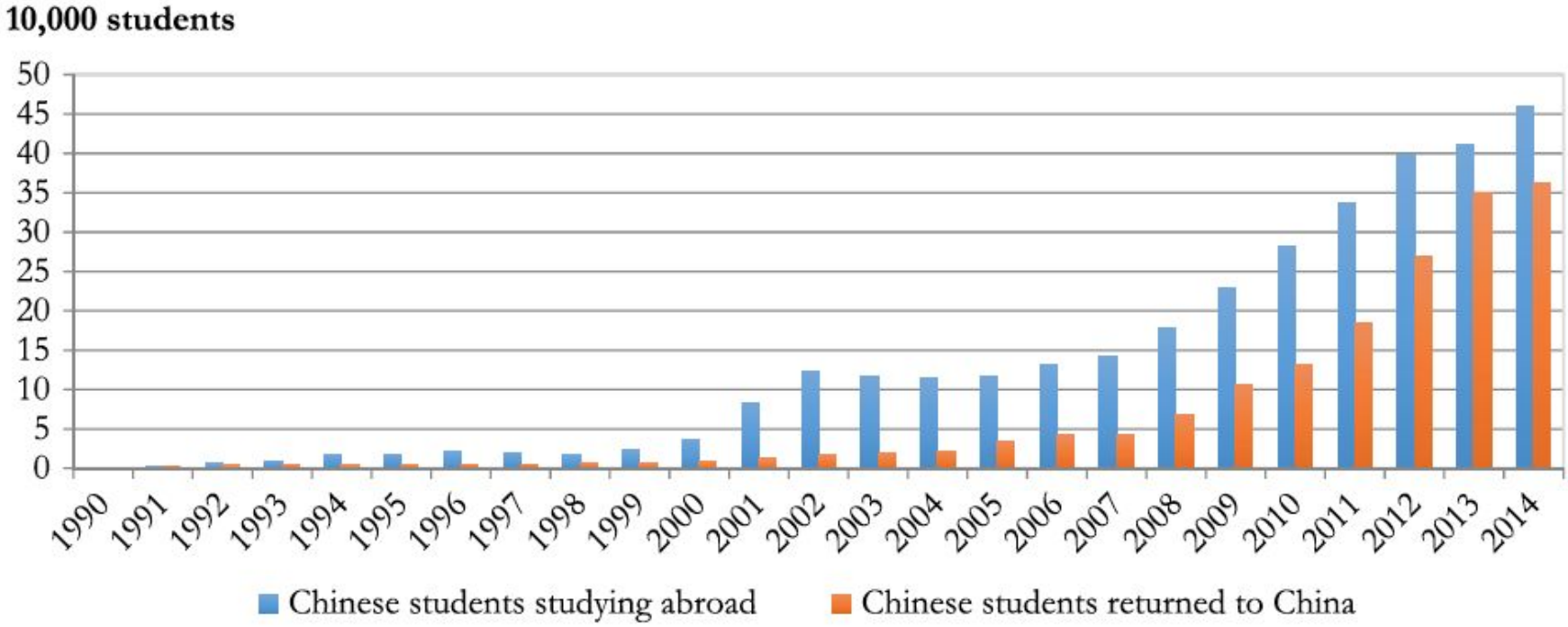
(inward and outward)



Inward FDI, outward FDI and foreign contracted projects during 1990–2013, in USD 100 million
– Fu et al., 2016: **Fig. 2**

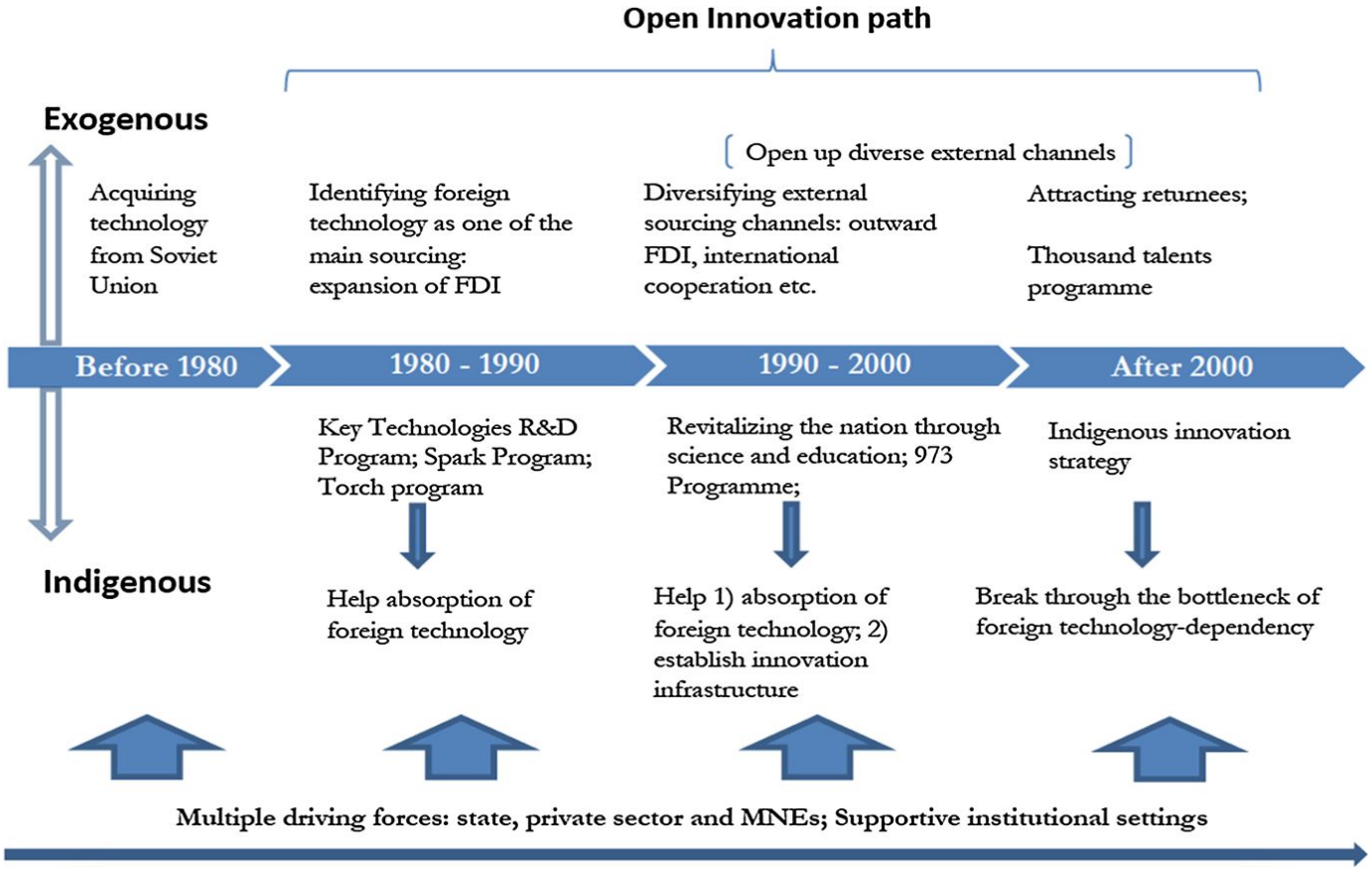
Human capital

(local and returnees)



Number of Chinese students going abroad and returning to China, from 1990 to 2014
– Fu et al., 2016: **Fig. 6**

So, which was China’s
STI strategy before 2006?



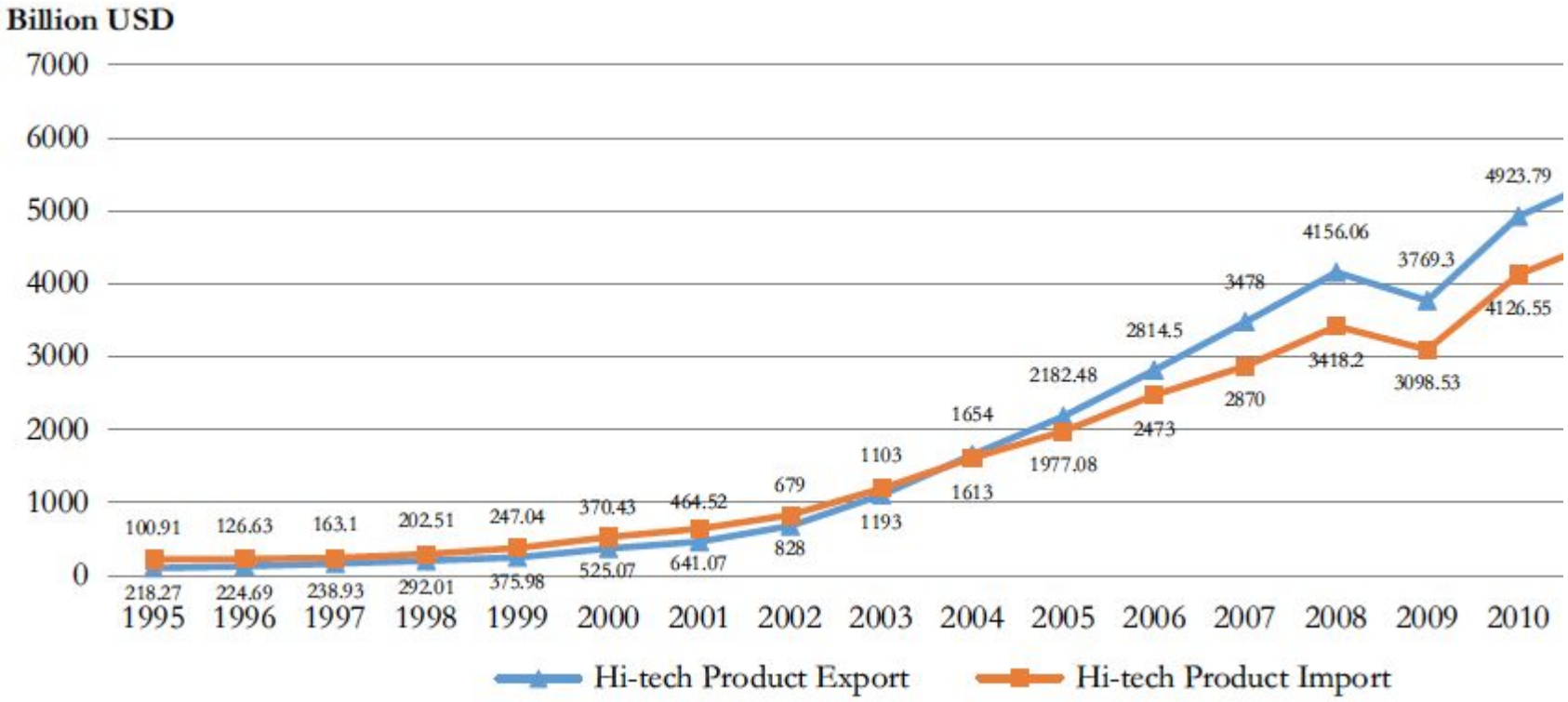
The synergy between exogenous foreign knowledge and indigenous capabilities in knowledge creation
– Fu et al., 2016: **Fig. 7**

STI policy in China after 2006

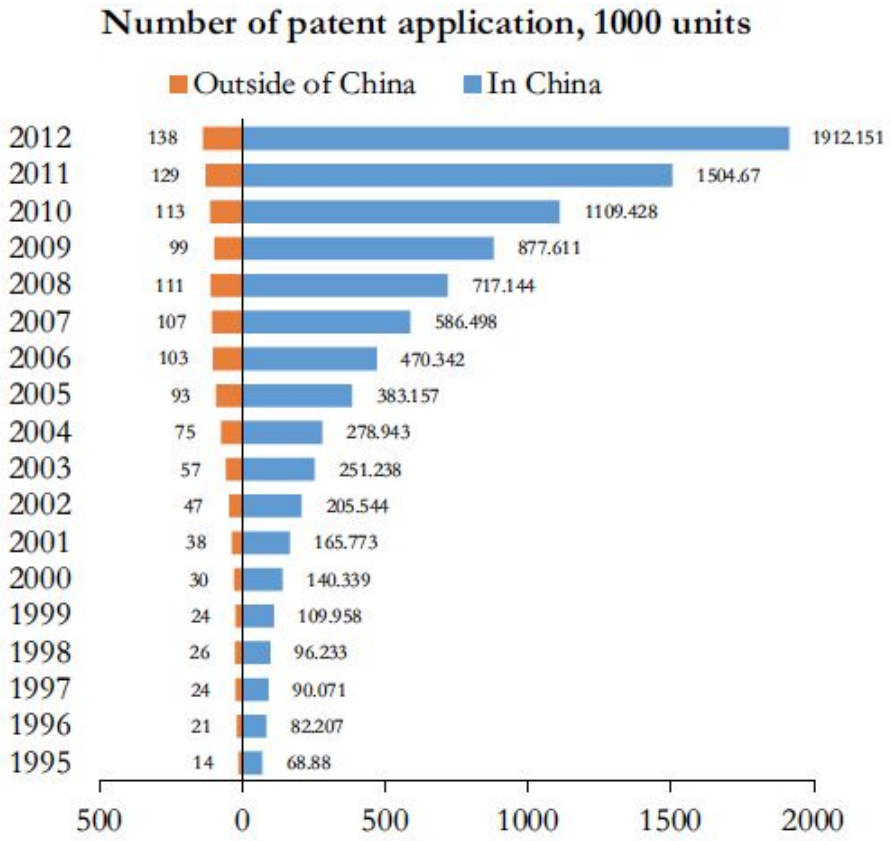
Key STI initiatives since 2006

2006	Medium-Long Range Plan for Science and Technology	targeting “indigenous innovation” (megaprojects)
2010	Strategic Emerging Industries (SIEs)	focus on 20 sectors grouped into 7 (energy, conservation, information technologies, biotechnology, precision machinery, materials and vehicles)
2015	Made in China 2025	focus on the use of information technologies in other industries, including those traditional (comparable to Industry 4.0)
		– Naughton, 2018: 380–382

Which achievements from the STI strategy?



Export and import value of high-tech products from 1995 to 2012, in billions USD
– Fu et al., 2016: **Fig. 9**



Number of patent applications (thousands), 1995–2012
– Fu et al., 2016: **Fig. 8**

However, Chinese patent applications have been driven upward by government policy to incentivize patents. These are pervasive and generous. [...] *Chinese patenting demonstrates Goodhart's law: "When a measure becomes a target, it ceases to be a good measure"*

– Naughton B, 2018: **388–389**

What else?

[FF.2]
What **print** of catching up strategy?

[FF.3]
What **position** within global networks?

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