The Innovation system of China: strengths and challenges

by

Bengt-Åke Lundvall, Aalborg University

Shulin Gu, Academy of Science

This presentation is based on collaborations in the past years between bal and Shulin Gu

- Lundvall, B.-Å. And Gu, S. (2011), China's move toward endogenous innovation and economic growth, paper submitted to 2011 Globelics Conference
- Gu, S., Lundvall, B.-Å. , Malerba, F., Liu, J. and Schwaag Serger, S. (2009), 'China's System and Vision of Innovation: An Analysis in Relation to the Strategic Adjustment and the Medium- to Long-Term S&T Development Plan (2006-20)', *Industry and Innovation*, vol. 16, issue 4-5, pages 369-388.
- Gu, S. and Lundvall, B.-Å. (2006a), 'Policy learning as a key process in the transformation of the Chinese Innovation Systems', in Lundvall, B.-Å., Intarakumnerd, P. and Vang, J. (eds): *Asian innovation systems in trasition*, London Edward Elgar Publishing.
- Gu, S. and Lundvall, B.-Å. (2006b), 'China's innovation system and the move toward harmonious growth and endogenous innovation', *Innovation: Management, Policy & Practice*, vol. 8, no. 1-2, 1-26.

The Innovation system of China: Structure of Presentation

- Strengths of the IS in China
- China's current investment in science, technology and innovation
- Challenges: what factors will determine the success of the new strategy
- Understanding the challenges that the innovation system is faced with

Strengths of the IS in China — the history of reform

- Since 1978 Deng Hsiao Peng initiated reform: new theory and new practice
- Three major changes:
  =>Decentralization
  =>Privatization
  =>Opening up to the rest of the world
- Important effect was liberation of oppressed entrepreneurial potentials
  =>Of local authorities
  =>Of all units at lower levels
  =>Of individuals (especially in resource-poor provinces such as Zhejiang)
- Laid the foundation for the dominant growth model, which has been investment intensive and export-oriented with local and regional initiatives as important drivers.

Reforms of research and innovation system

- Since 1985
- **“Systemic” view:** regarding the relationship between the supply and demand of knowledge;
- **Sophisticated diagnosis:** the weaknesses of the existing system (inspired by the Soviet Union model) as being the **disconnection** of production from the use of technological knowledge
- **Method chosen:** to change the governance from a government directed toward market mediated interaction

Reform of research and innovation system, in particular

- **A pragmatic policy learning process**

  =>“Technology market” (1985)

  =>Merger of PRO with industrial enterprises (1985)

  =>Spin-off and Spin-on enterprises and the Touch Programme (1988) (e.g. Lenovo)

  =>Transformation of R&D institutes into market-oriented companies

- **Results:**

  =>Emergence of an active ICT industry;

  =>A a growth in technology import;

  =>The R&D system reform contributed to rapid growth in the 1980s and 1990s;

A strength of the Chinese System has been the capacity to engage in pragmatic policy learning

Good capacity of Chinese Leadership to engage in "policy learning"

- It is interesting to note the extent to which the Chinese leadership already in1985 understood technical innovation as a systemic process, where the actual linkages between scientific production and material production were seen as essential for the system's ability to innovate.
- The Chinese leadership reacted pragmatically to the 'failed attempts' to create markets for knowledge and technology. When the original objective could not be realised they gradually revised objectives and the design of reforms taking into account what seemed to work in practise.
- Combined with decentralised policy learning where successful local experiments are diffused nation-wide
- IS THIS A TOO ROSY PICTURE?

The Innovation system of China: strengths and challenges

- Strengths of the IS in China—observed from the history of major reform waves and the institutional transformation by an external researcher
- China's current investment in science, technology and innovation
- Challenges: what factors that will determine the success of the new strategy
- Understanding strengths and challenges that the innovation system in China possesses and is faced with

Since around 1999-2000 China's investment in science, technology and innovation increases dramatically.

Table: China ' s R&D-effort seen in global perspective, 1990, 2000 and 2007 (share of world total R and D % and R & D as a percentage of GDP)

	1990		2000		2007	
	Share	R&D-int.	Share	R&D-int.	Share	R&D-int.
United States	38.2	2.3	37.2	2.3	34.7	2.3
Japan	16.3	3.1	13.0	2.9	13.0	3.4
China	3.0	0.8	6.7	1.0	9.2	1.5

Source: Arond and Bell (2010)

Since around 1999-2000 China's investment in science, technology and innovation increases grammatically

Table: Number of doctoral degrees awarded 1995-2003, and annual growth rate

	1995	2003	Annual growth 95-05
United States	41.747	40.740	0.4%
Germany	22.387	23.043	1,5%
Japan	12.645	16.314	2.9%
China	4.364	18.806	18.7%

Source: Veugelers 2010

All growth rates are close to 20% and to be compared with stagnation in the West and in Japan, **this shows high ambitions - now it is a major challlenge for China to raise the quality of the knowledge production**

New strategy announced in 2006

- China announced in 2006, the strategic decision to “Build an Innovative Country by Endogenous or ‘independent’ Innovation with Chinese Characteristics.”
- The new strategy is referred to as a *strategy for innovation-based and harmonious development* (socially, economically and environmentally).
- The new strategy embodied in National Medium-and long-term Science and Technology Development Plan (2006-2020) placed concepts such as innovation and innovation system centrally
- For the first time the plan emphasized that enterprises should be regarded as the most central component of the innovation system.
- Together with the major part of the plan which includes massive investment in science and technology, the plan includes initiatives for institutional renewal to support innovation, such as the rules for taxation of investment in R & D, intellectual property protection, governmental procurement and much more.

Advantages of IS in China appeared in the above discussion

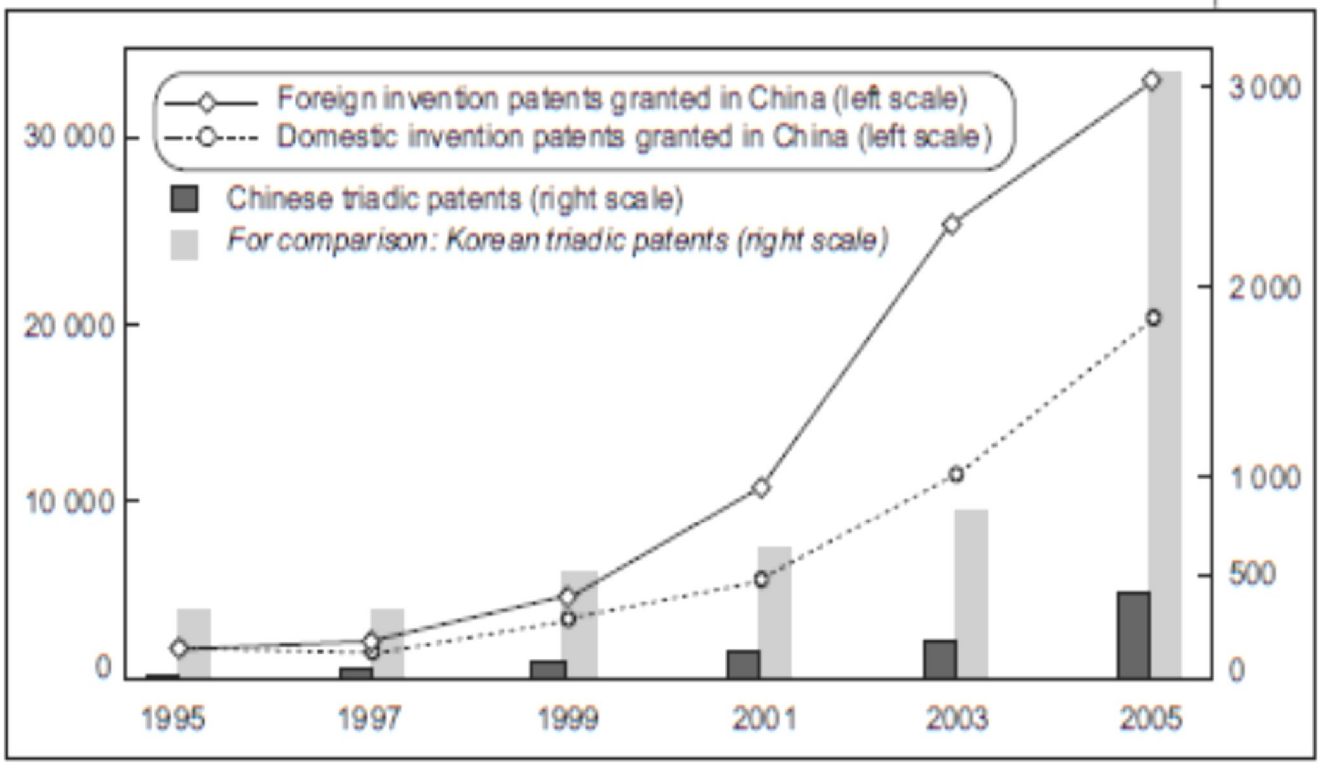
- The first is a political leadership at the central level that see knowledge and innovation as the main driving force for future growth;
  - Reflects a strong presence of engineering and natural science in the top leadership the political bureau of the central committee
- As mentioned a “Good capacity” of Chinese Leadership to be pragmatic and engage in “policy learning”
- The second is a population where families see education as the only certain road to social advancement.
- This may be reinforced by the fact that China, including the Communist Party, is a meritocracy where advancement is based upon success in education.
- IS THIS PRESENTATION OF THE UNDERSTANDING OF THE IMPORTANCE OF KNOWLEDGE TOO ROSY?

The Innovation system of China: strengths and challenges

- Strengths of the IS in China—observed from the history of major reform waves and the institutional transformation by an external researcher
- China's current investment in science, technology and innovation
- Challenges: what are the factors that will determine the success of the new strategy
- Understanding strengths and challenges that the innovation system in China possesses and is faced with

Explosive increase in investment in R&D while China's innovation performance is less impressive: Patenting

* Patenting trends (number of patents) Compared with South Korea



Source: China Statistical Yearbook on Science and Technology; OECD.

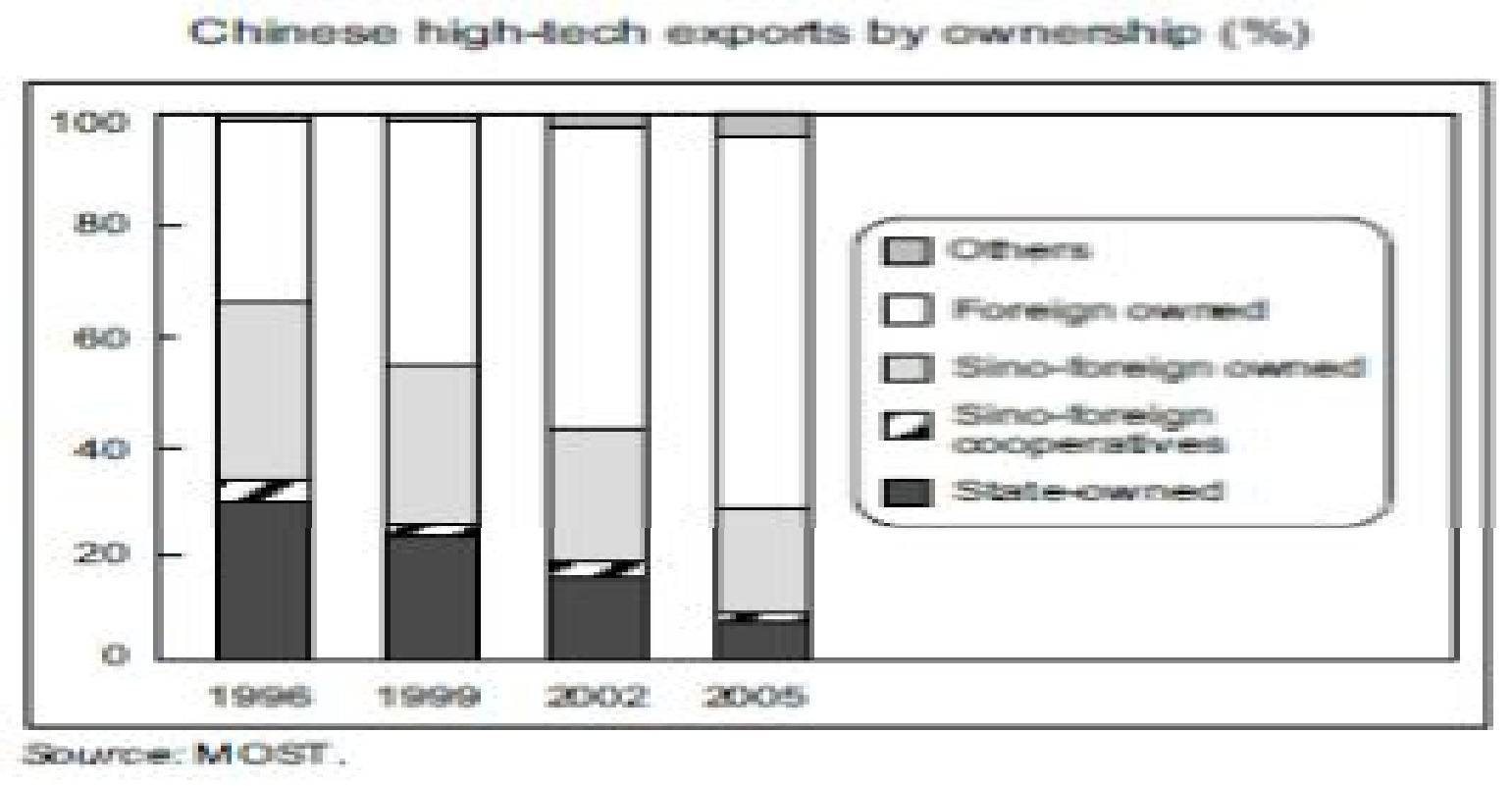
Sector-wise the R&D-Intensity remained low around 2000 - International comparison

R&D intensity of high-tech industries and total manufacturing in selected countries

	China 2003	US 2000	Japan 2001	Germany 2001	France 2002	UK 2001	Korea 2003
Manufacture	2.0	8.2	9.9	7.6	7.4	6.5	7.3
Total High-tech industries	4.4	22.5	26.3	23.8	28.6	23.1	18.3
Medical and pharmaceutical products	2.7	20.2	22.9	22.7	27.2	50.0	4.4
Electronic and telecommunications equipment	5.4	18.6	18.6	43.7	57.2	18.5	23.4
Computers and office equipments	2.5	30.7	59.5	19.7	15.8	4.2	4.4
Medical equipments and meters	3.0	30.2	28.7	14.8	16.1	8.8	10.7

Hi Tech export

* Now China is the leading exporter of ICT; but the exports are mainly by foreign owned enterprises



Why is China's innovation performance less impressive in spite of vast investment in R&D ?

- Positive outcomes from investment in R&D have to be associated with many other factors!
- These factors constitute the quality of an innovation system, and determine the efficiency of the innovation system.

Challenges: what factors that will determine the success of the new strategy?

- For China to achieve stronger innovation performance from the vast investment in R&D, improvement in organizational learning, and in interactions between firms and universities and with customers, might be one of the most urgent tasks.
- All the actors: industrial enterprises, R&D institutes, educational agencies, and supportive institutions need reforms

  => in incentive structures

  => in work organizations

  => in management styles
- that strengthen the innovative capacity or efficiency of the actors and that make them competent to deal with competition raised by multinationals on an equal basis
- DOES THIS CAPTURE THE MOST IMPORTANT CHALLENGES?

The unique growth performance

- Rate of real terms economic growth around 9% per annum 1978-2004
- Investments were 49% of GNP first half of 2005.
- Savings ratio 40-45% of GNP (cf. 21% for international average).
- FDI less than 10% of total investment.

China as the export-oriented factory of the world

- Value added 2003:
  - Manufacturing 53% (US, Brasil, India and OECD less than 30%)
  - Services 32%
  - Agriculture 16%
- Export+Import/GNP= 75% (US, Brasil, India och Japan=25-30%).

Growth success may not be sustainable in the future

- China's growth is based upon the massive movement of labour from manufacturing – cf. Growth models by Adam Smith, Verdoorn and Kaldor.
- Extensive development along this trajectory may not be sustainable – social capital and natural capital is at risk. Problems with:
  - Inequality
  - Urbanisation
  - Environment
  - Resources

The new perspectives – harmonious development and endogenous innovation

- The next five year program
  - Give strong emphasis to endogenous innovation – as opposed to imitation strategies
  - Harmonious development – social, ecological and energy saving
  - Gu-Lundvall paper links the two and argues that a stronger focus on domestic needs must be an important part of the new strategy

Decentralisation, the incentive system and sustainable development?

- Current incentive system gives strong urge at regional level to engage in economic growth and little weight to sustainability.
- Extremely uneven regional development of public services both in economic terms and welfare services such as primary school and health
- Is it possible to develop a new growth model more oriented toward innovation for the home market and more sustainable without reducing regional autonomy.

.

Four Questions to the plan

- How to reform governance and management at the enterprise level – on the need to break path dependency and low ambition for innovation?
- How to shape incentives at the regional/local levels that support a more sustainable growth path?
- How to reform and restructure change education – breaking the imitation syndrome
- How to balance national interest of endogenous innovation and open innovation?

Transition of development mode and importance of policy learning

- Upgrading the skills of employees and building learning organisations within enterprises is increasingly important for transforming investments in Science and Technology into economic growth.
- Promoting innovations that address domestic needs is a very efficient way to enhance the innovation capacity of enterprises.
- One of the most difficult tasks might be to anchor the new development strategy regionally and to make regional powers contribute both to endogenous innovation and to harmonious development.
- China has become a major player in the Global knowledge landscape. To master this new responsibility and new role will take some policy learning .
- China is now testing the hypothesis of the knowledge based society and the rest of the world is watching.

Lessons for development strategy

- Pragmatism in the use of market and plan
- Early system perspective
- Policy learning and use of regional experimentation
- Managed openness

Problems:

- The limits of STI strategy – need for DUI
- The importance of open and critical education system that support collective creativity
- The difficulty to shift from one trajectory to another

Xiaoling

- Well structured and well written
- Please explain the choice of terminology: **decomposition and recombination – should it be seen as two stages in reverse engineering?**
- **Von Hippel on the role of lead Users and on how learning by doing is done.**
- **Why and how do some firms overcome the big gap by connecting to external agents? Does it reflect specific governance.**

Javier

- Well written and well-structured paper.
- On explaining why there are Argentinian growth firms in a period of crisis. Assumption that technical and non-technical innovation are complementary in supporting economic performance. How do you define complementarity in this context? Reference to Pierre Mohnen article?
- So far only descriptive statistics but there is a sketch of the econometric model to be used. Model looks complete and relevant. But why use the term ’treatment’?