Domestic Reform and Global Integration: The Evolution of China’s Innovation System and Innovation Policies

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Outline

This presentation tries to position the evolution of China’s innovation system in a historical and socio-economic context:

- **History**—China’s innovation system: A review of recent history;
- **Context**—Reform and Openness: China in transition;
- **Process**—Domestic reform and international integration: evolution of China’s innovation system in the reform era;
- **Policies**—China’s specific policy initiatives
- Implications
I. A review of recent history

- Despite China’s long history in inventive activities and the contribution it has made to the world, China lagged behind the West since Ming Dynasty (1368-1644);
- Not until mid-19th century (1847), China began to look to the West and send students to study abroad, many to the US.
China’s national innovation system--contemporary universities and research institutes

On Oct. 2, 1895, the then Emperor Guangxu approved the petition submitted by SHEN Xuanhuai, to establish the first contemporary Chinese university in Tianjin City: Beiyang University (the current Tianjin University).
By 1948, China had 210 universities with over 155,000 students, including graduate students:

Central Research Academy was established on June 9, 1928, with 70 research institutions in 1935. By 1949, only around 30 left, with a research staff of about 50,000.
China’s Innovation System:1949-1966

After the founding of the People’s Republic of China in 1949, China’s innovation system was restructured to change to a more centralized system based on the Russian model:

- Functional separation and mission orientation;
  - human resource development => universities;
  - basic research => Chinese Academy of Sciences;
  - applied research => ministerial/provincial research institutes;
  - development => in-house services in enterprises.
Achievement and setbacks

☐ Achievements:
  - By 1965, China had established over 1700 S&T institutions, with over 150,000 scientists and engineers;
  - Some of the major achievements include synthetic bovine insulin, atomic bomb, and oil field discovery in Daqing.

☐ Setbacks
  - The breakup with USSR in S&T cooperation in the late 1950s left a deep scar in the S&T community in China and made it realize that being self-reliant was essential in S&T development.
II. The Context: Reform and Openness in China since 1979

- Reform and Openness---The great social transformation in China since 1979:
  - Economic system:
    - Central planning => market-based;
  - Industrial structure:
    - Global manufacturing hub;
  - Society:
    - Rural => Urban; Closed => Open
  - Governance
    - Personal charisma and centralization of authority => rule of law and broad participation

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Economic system: From Central Planning to market-based
Industrial structure: global manufacturing hub

- **Agriculture:**
  - 1980 = 30% => 2000 = 14.8% => 2007 = 11.3%

- **Manufacturing:**
  - 1980 = 49% => 2000 = 45.9% => 2007 = 48.6%

- **Service:**
  - 1980 = 21% => 2000 = 39.3% => 2007 = 40.1%
Society: rural and closed => urban and open

- Rural => Urban
  - Urban population 1982=20.6% => 46.6%=2009

- International Linkage
  - Economy: Self-reliant => major world trading partners
    - FDI > $60 billion
    - international trade as the percentage of GDP
      - 1978=10% => 2005 =62%
  - Chinese nationals going overseas:
    - 2000=10.47 million  2007=40.95 million
Governance structure

- Village election and township election experiments;
- Administrative and legal systems reforms;
- Broader public participation in the policy process:
  - e.g. public hearing; internet monitoring;
- The growth of NGOs and civil society;
- Anti-corruption campaigns;
- ......
III. Evolution of China’s Innovation System in the Reform Era

- The evolution of China’s innovation system has mirrored the great transformation of Chinese society in general. The major themes of the changes of China’s innovation system since 1979 are:
  - Reform—market-oriented reform based on incentive and institutional changes;
  - Integration—domestic institutions trying to integrate into the global system while maintaining their unique identities.

- Three waves of major changes:
  - Mid-1980s: domestic reform informed by global experience;
  - Late-1990s: domestic reform coupled with global integration;
  - 2006-: global integration enhanced by domestic reform.
3.1--The first wave of changes: mid-1980s-1990s

- **Policy orientation**
  - Creating Incentive regime for R&D organizations to serve for the economic development.
  - In 1985, the government began to push for a major reform aimed at changing the S&T system, specifically public research institutes:
    - Gradual funding cuts to all research institutes;
    - new R&D programs based on competition and peer review;
    - new approaches to the management of research organizations;
    - creation of platforms for technology transfer (science parks);
    - incentive for S&T personnel to “jump into the sea (becoming entrepreneurs)”;
    - ........
The outcome: Changing pattern of R&D spending

<table>
<thead>
<tr>
<th>Organization</th>
<th>1986 (%)</th>
<th>1997 (%)</th>
<th>2001 (%)</th>
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<tr>
<td>Industry</td>
<td>35.3</td>
<td>42.9</td>
<td>60.4</td>
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<td>Research Institutes</td>
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<td>Other</td>
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<td>2.1</td>
<td>2.1</td>
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</tbody>
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3.2--Second wave of changes: Late 1990s to mid-2000

- **Policy orientation**
  - to focus on institutional reforms by clarifying the institutional roles of different organizations in China’s national innovation system.

- **Public Research Institutes**
  - Knowledge Innovation Program by Chinese Academy of Sciences (CAS):
    - Major institutional support from the government to CAS to establish innovation centers (lean and mean, with high pay and high pressure);
  - Reforming Public Research Institutes: pushing them to the market
    - By the end of 2003, 1050 application-oriented research institutes were transformed into business since 1999 government reform.
 Universities

- Dramatic increase in college enrollment from 1999
  - The gross enrollment rate jumped from 12.5% in 2000 to 24.2% in 2009.
- Strengthening research universities—985 program

 Business

- Establishing R&D centers in major SOEs and supporting small business innovation
  - Small and Medium Enterprise Innovation Fund;
- Attracting MNCs to establish R&D centers in China
  - 750 MNC R&D centers were established in Beijing, Shanghai, Guangzhou, Chengdu, etc by mid-2005.
The outcome

- Greater role of Industrial R&D:
  - Industrial R&D:
    - 1997=42.9% => 2001=60.4% => 2007=72.3%

- Greater participation in the global science enterprise
  - Publications in SCI, SSCI indexed journals as a benchmark for universities and research institutes (see graph);

- Massive expansion of higher education:
  - Gross enrollment rate:
    - 1990=3.7%; 2001=10%; 2005=21%, 2009=24.2%
Research output by different countries measured by scientific papers indexed in Web of Science (1999-2008)
(US (not shown)=340,000; China=112,000)
3.3--The third wave of changes since mid-2000s

General Background

- The need for China to break away from the growth model relying on cheap resource and labor, and to focus more on innovation and sustainability;
- The need for China to break away from the traditional positions in the international division of labor; and to integrate with the global system on new models (see graphs);
An analysis of US-China ATP product trade found that:

- Over 90% of surplus is in processing trade;
- Over 90% of surplus is generated by MNCs and joint ventures.
The recent policy initiative

- Policy orientation
  - Changes in overall development strategy -- from GDP focused growth to coordinated development;
  - Changes from S&T policy to innovation policy

- The median and long range S&T plan in 2006
  - Guidelines for future S&T development:
    - promote indigenous innovation and work to make China an innovation-based country in 2020;
    - A group of priority areas of basic and applied research;
    - 16 mega research projects;
    - ......
An integrated innovation policy

- Policy scope=>beyond R&D programs
  - R&D investment, tax incentives, finance
  - Government procurement (abolished in 2011)
  - Human resources, IPR, research platforms
  - SME, Communication with the public…

- Policy coordination=>beyond MOST
  - Many other government agencies are involved;

- Policy implementation=>beyond S&T institutions
  - Business, academia, and other supporting organizations
3.4. Summary

- Domestic reform
  - National reform agenda provides initial impetus for reform in the innovation system;
  - The reform context has allowed for bold reforms in innovation system;

- Global integration:
  - Learning from the global system (science parks, knowledge economy and etc);
  - Participating in the global system (global science publications)
  - Integrating into the global system (two way exchanges)

- Virtuous cycle of reform and integration:
  - Reform=> conditions for better integration=> demand for more reform=>……
IV. Implications--Global Governance Challenges:

- Declining supply of public goods:
  - Shortage of national funding for basic research
  - Privatization of public knowledge

- Coordination problem:
  - Super-competition for public funding in “hot” fields;
  - Unhealthy competition on standards

- Knowledge divide
  - Basic education and higher education;
  - Lack of knowledge institutions for knowledge diffusion;

- Brain drain problems for developing countries
Global supply v.s. local demand in public knowledge

- Research agenda setting: whose agenda?
- Global publication system vs local dissemination (see graphs below)
  - Through what channels?

Inadequate IP regime:

- The distorted use of IP regime (TRIPS) to block innovation;
- The dominance of MNCs in licensing and standards (see case below)
MNCs dominance in standards setting

- About 50 global corporations determine what 250 ICT standard consortia do, and more importantly, how they do it.
- The top ten leaders: IBM, Microsoft, Fujitsu, Intel, Hewlett Packard, Hitachi, Sun Microsystems, Nokia, Ericsson and Texas Instruments.
- Of the 50 major players, 25 are from the US, 12 from the EU, 8 from Japan, 5 from emerging countries.
Governance reforms -- some initial ideas

- A reform on the global governance system for innovation?
  - A more balanced IP regime
    - Reform on TRIPs
    - Improved governance of standards
  - Regional higher education system and knowledge institutions for developing countries?
  - Creative ways of using existing knowledge?
    - Knowledge pool for green technology;
    - Accelerated diffusion of green technologies
  - ......

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Thank you!