



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

**Dr. Lan Xue, Professor and Dean
School of Public Policy and Management
Tsinghua University**

Emerging Economy Perspectives and Priorities in the New Multi-Polar World, November 14-15, 2011, Beijing, China

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.



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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.

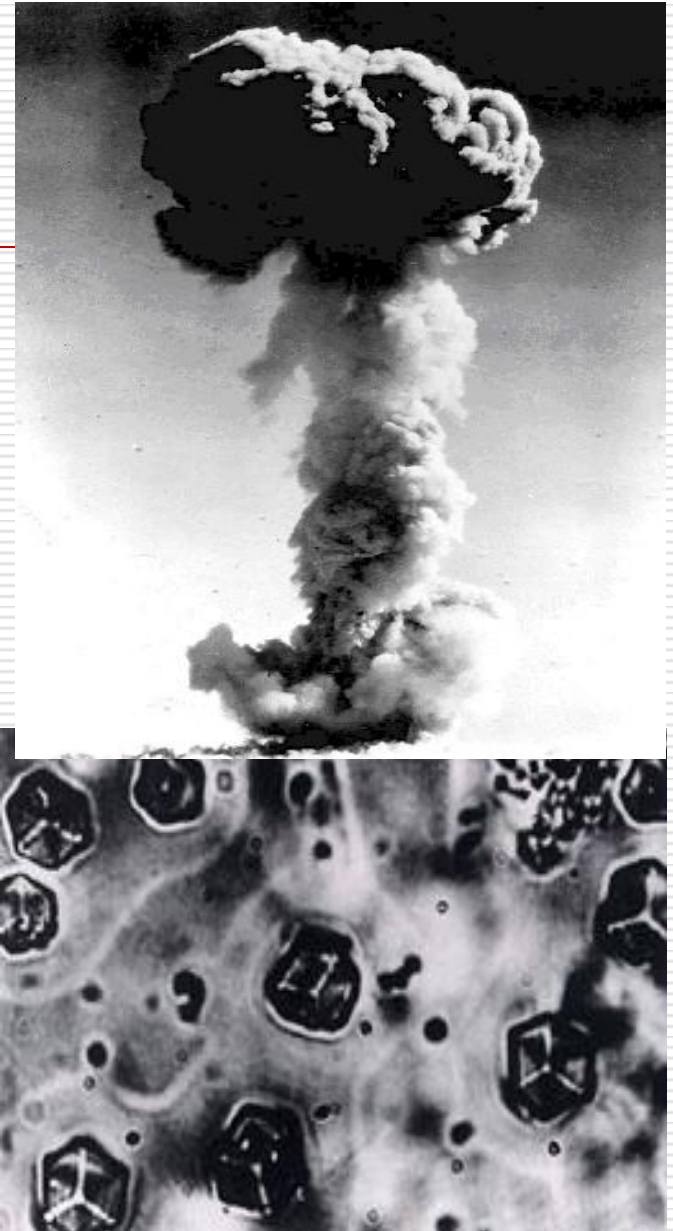
Achievement and setbacks

□ 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

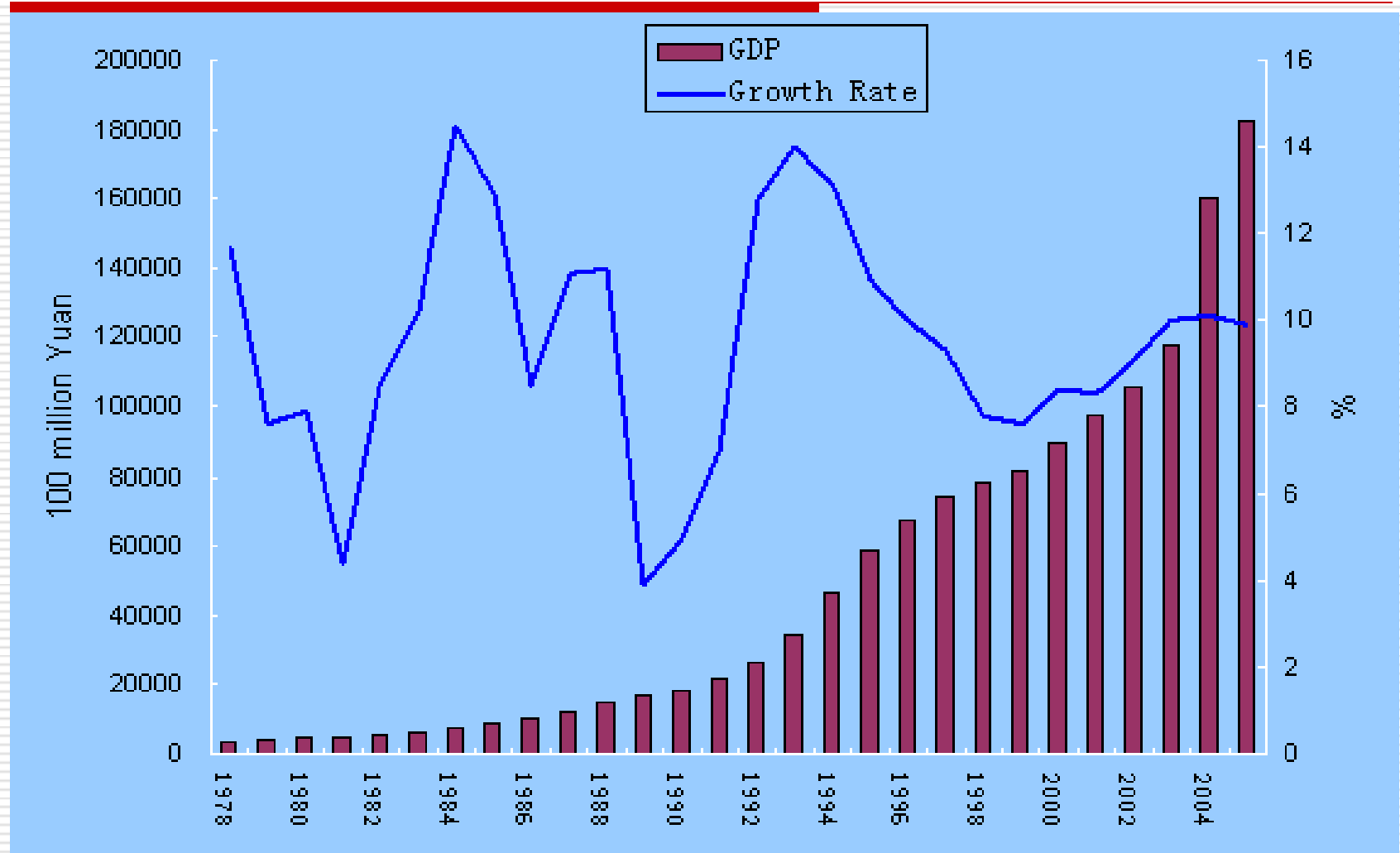
- The breakup with USSR in S&T cooperation in the late 1950s left a deep scar in the S&T community in China and made it realize that being self-reliant was essential in S&T development.



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

Economic system: From Central Planning to market-based



Industrial structure: global manufacturing hub

□ Agriculture:

■ 1980=30% \Rightarrow 2000=14.8% \Rightarrow 2007=11.3%

□ Manufacturing:

■ 1980=49% \Rightarrow 2000=45.9% \Rightarrow 2007=48.6%

□ Service:

■ 1980=21% \Rightarrow 2000=39.3% \Rightarrow 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)”;
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The outcome: Changing pattern of R&D spending

<u>Year</u>	<u>1986 (%)</u>	<u>1997 (%)</u>	<u>2001 (%)</u>
<u>Organization</u>			
Industry	35.3	42.9	60.4
Research Institutes	60.7	42.9	27.7
Universities	4.0	12.1	9.8
Other	0	2.1	2.1

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

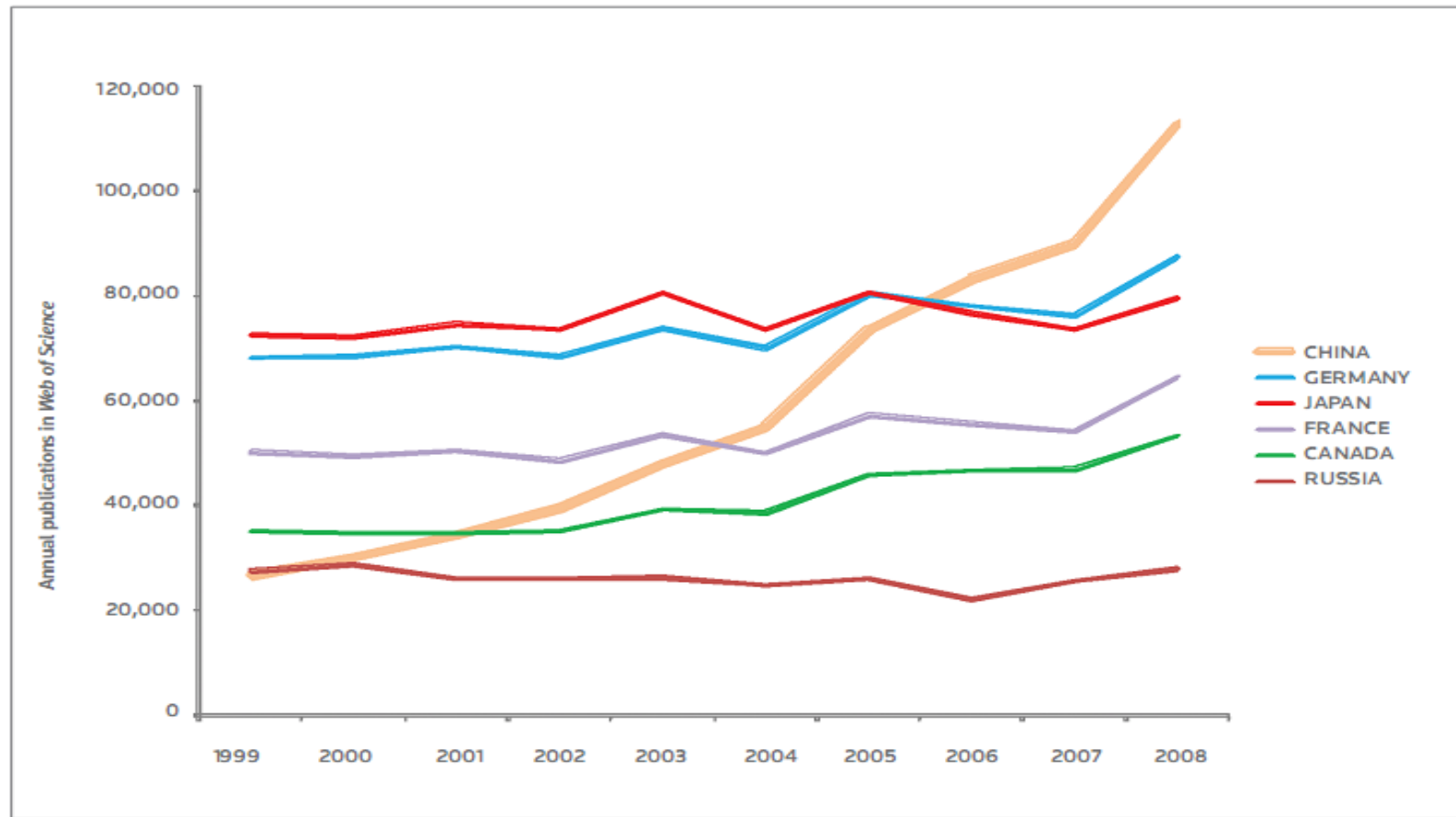
☐ Business

- 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

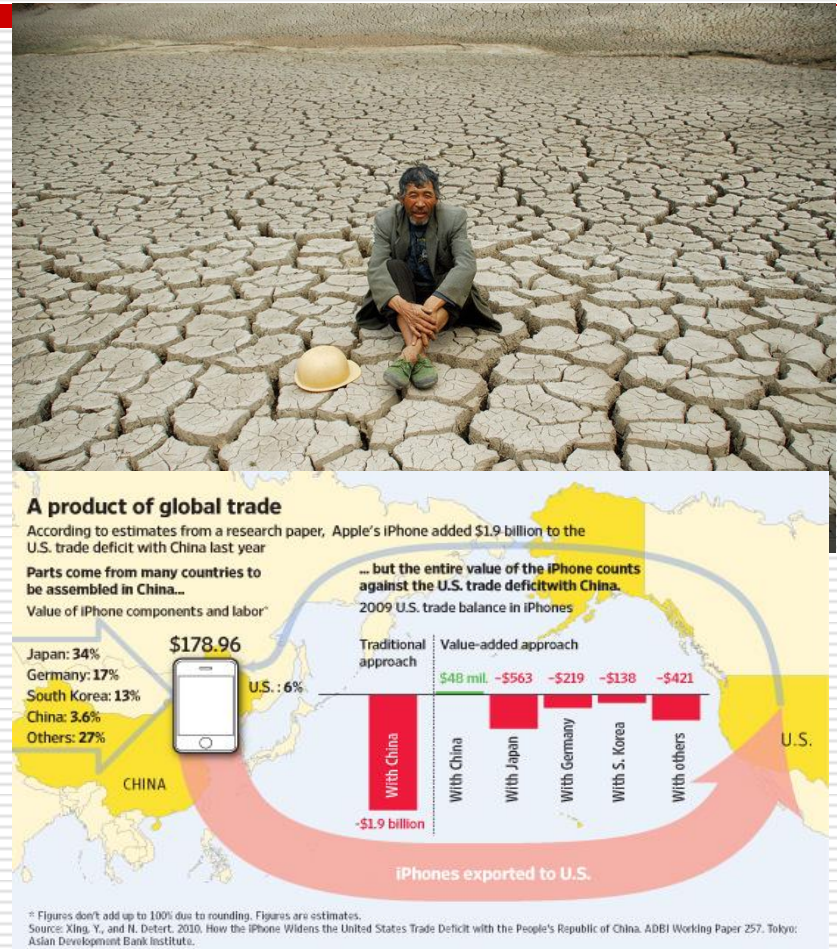
- ❑ Greater role of Industrial R&D:
 - Industrial R&D:
1997=42.9%=>2001=60.4%=>2007=72.3%
- ❑ Greater participation in the global science enterprise
 - Publications in SCI, SSCI indexed journals as a benchmark for universities and research institutes (see graph);
- ❑ Massive expansion of higher education:
 - 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)



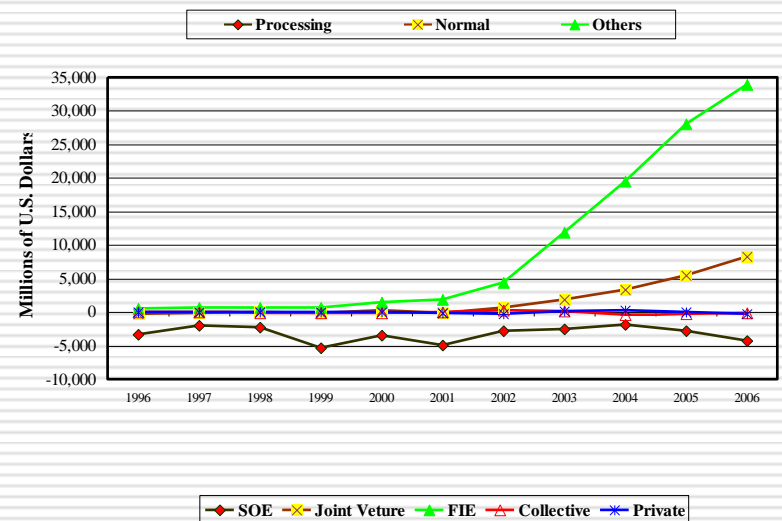
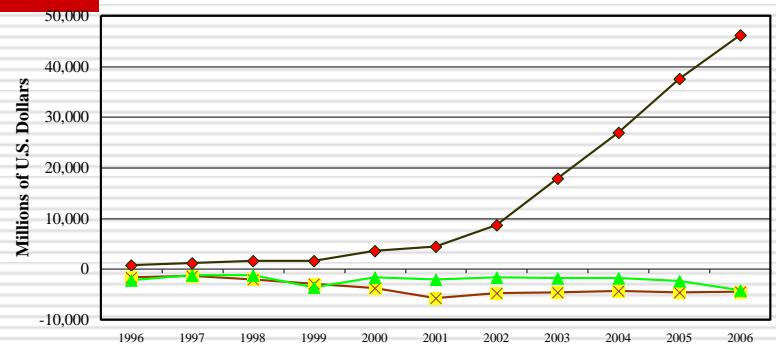
3.3--The third wave of changes since mid- 2000s

- 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

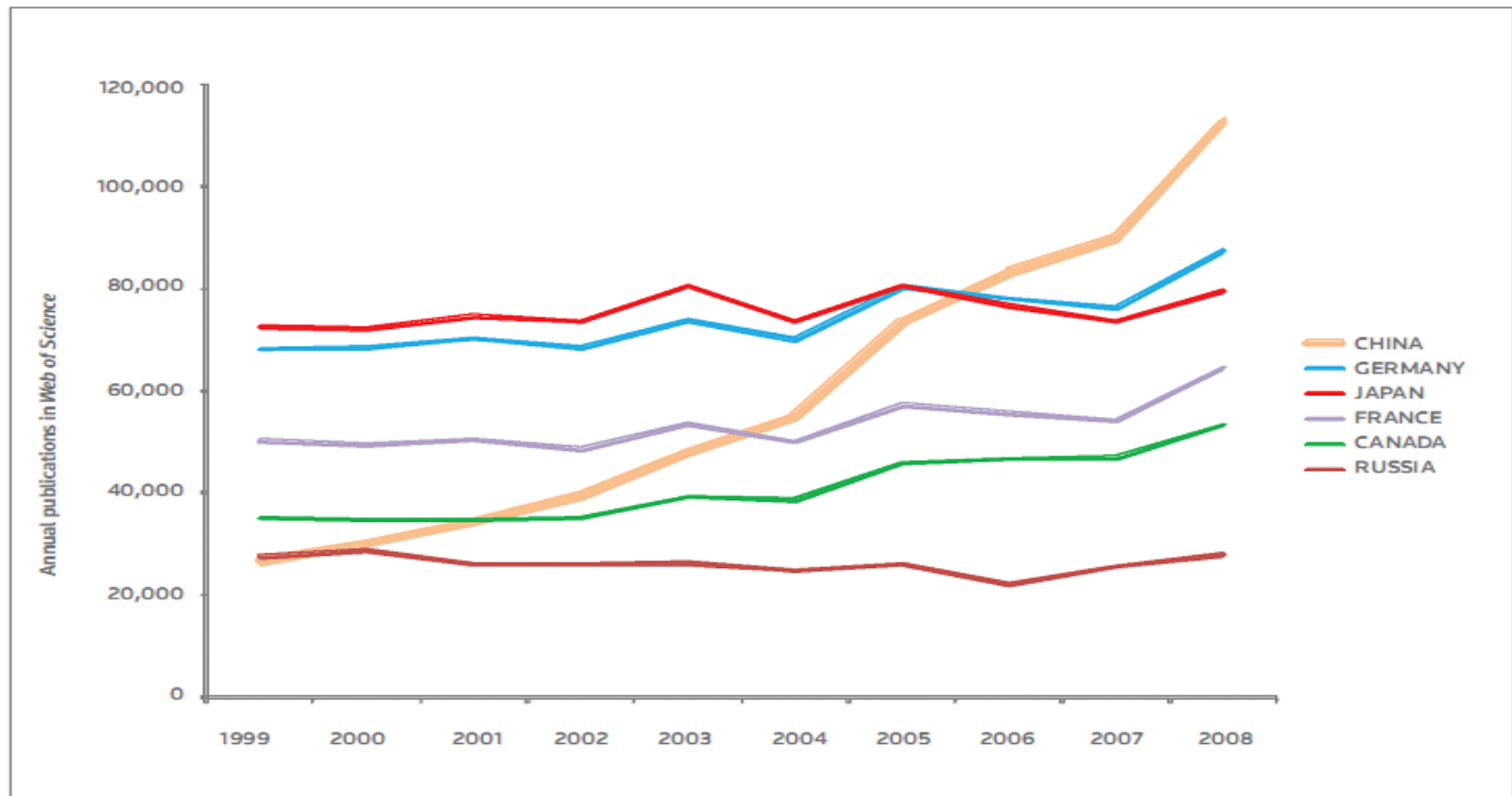
3.4. Summary

- 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

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- 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!

