

The Changing Geography of Innovation: The Rise of the BICs-Challenges and Opportunities

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Structure of Presentation

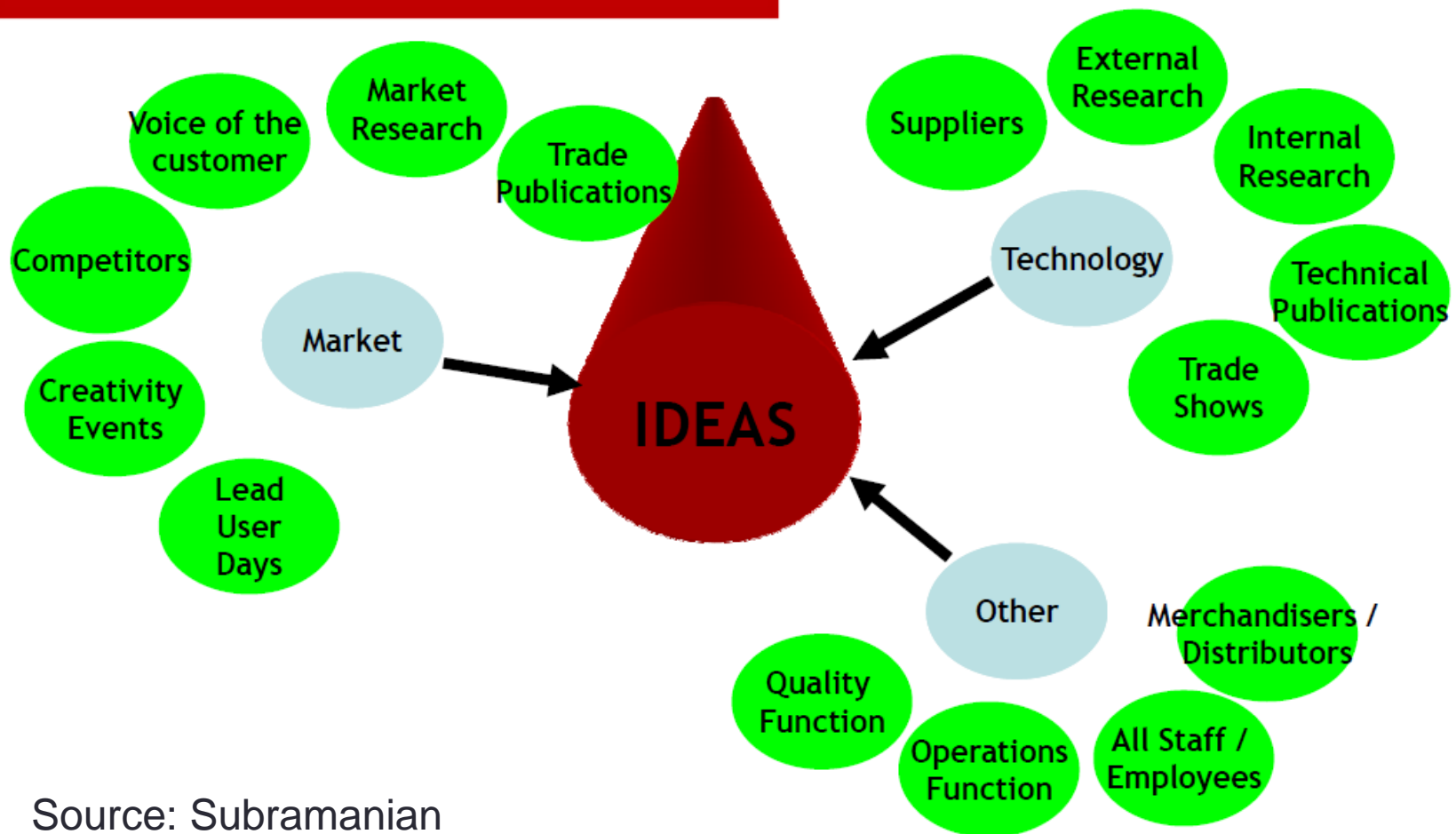
1. What is Innovation?
2. Changing Geography of R&D
3. National System of Innovation
4. The Global Innovation System
5. The TNC as the Main Driver
6. Lessons from China
7. Implications for Advanced Countries
8. Implications for Developing Countries
9. Challenges and Opportunities for the Global System
10. Conclusion and Some Implications for Policy

1. What is Innovation ?

- Innovation is not just:
 - a new product, process , design,
 - or form or organizing or delivering or using a product or service that is new to the world
- But one that is new to
 - the country,
 - the sector or
 - the unit using it
 - firms
 - government
 - social organizations
 - individuals

Sources of Ideas for Innovation

Ideas



Source: Subramanian

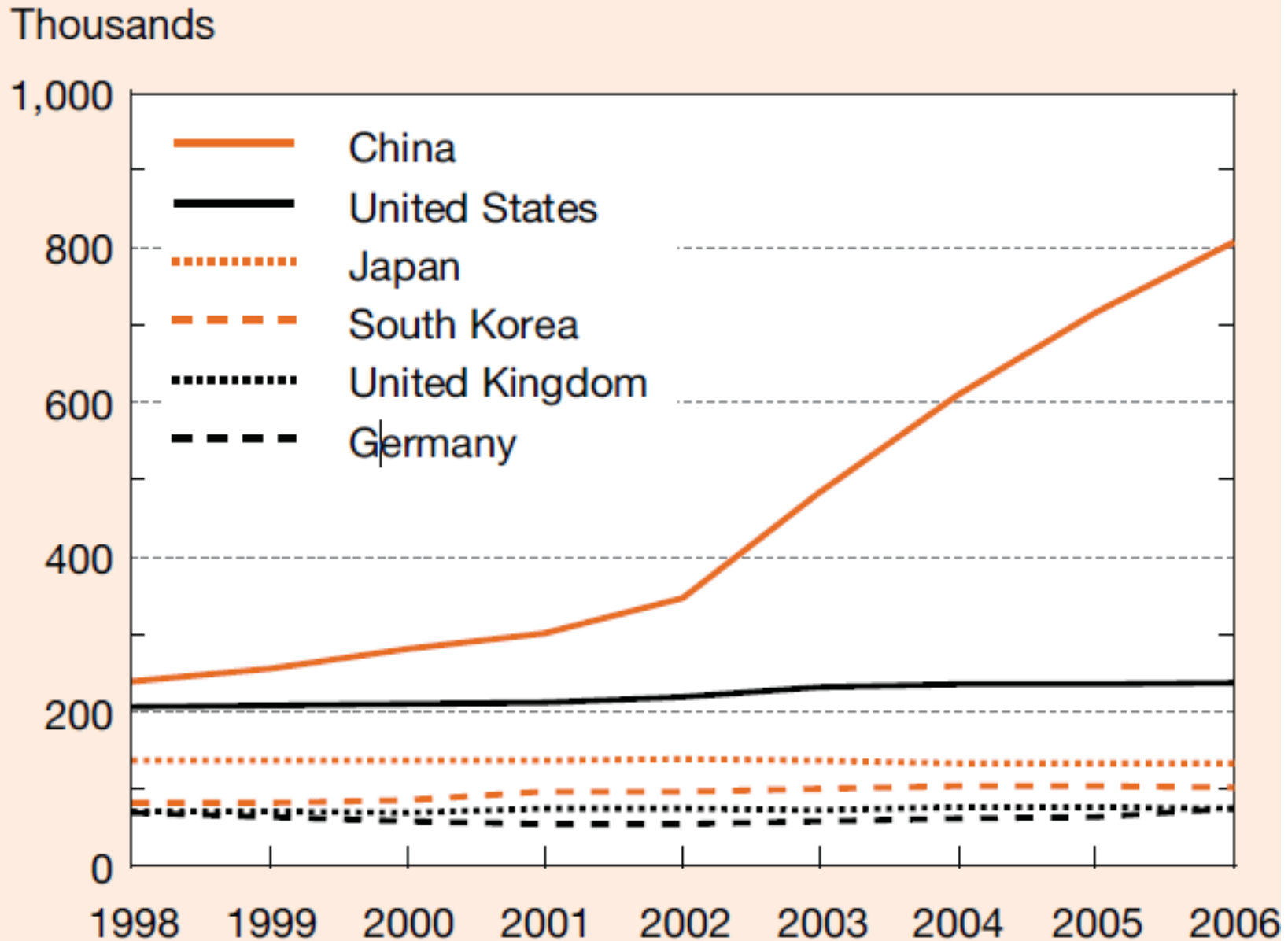
Role of Innovation

- Innovation plays critical role in helping to;
 - Improve competitiveness and economic growth
 - Improve welfare
 - Address major challenges such as security, climate change, etc.
- Innovation is complex
 - Frontier innovation vs. local innovation
 - Involves multiple actors
 - Involves interaction between narrow innovation system and broader economic and social context
- Countries can dramatically improve their position by acquiring existing knowledge
 - Much of it, especially for improving social welfare ,is in public domain
 - Lots of it can be acquired through formal modes
 - Some can also be acquired through informal copying and reverse engineering
- **But countries also have to develop own capability to acquire, use, and create knowledge**

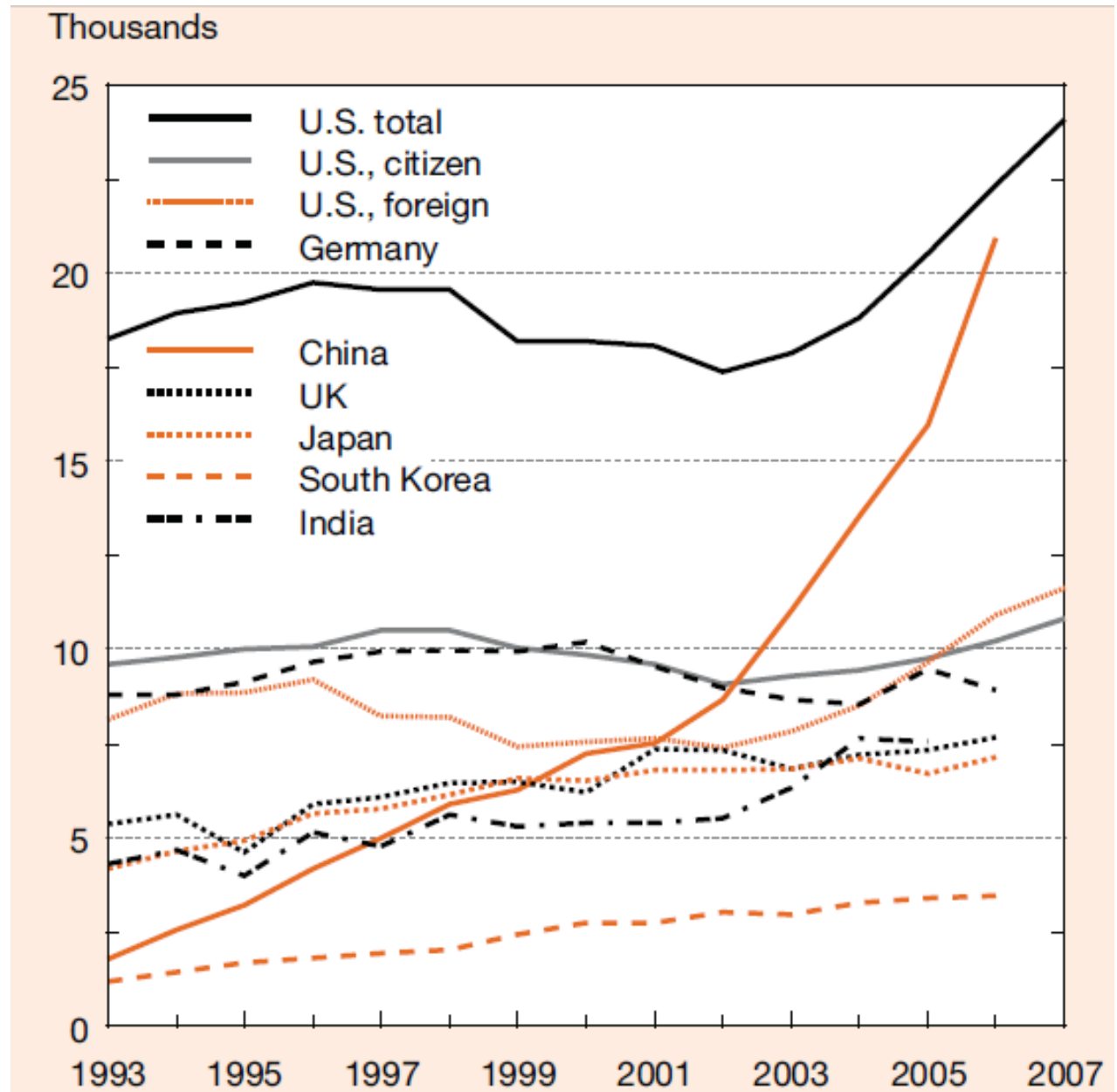
2. Changing Geography of Innovation

- Education
- Degrees in Natural Sciences and Engineering
- Researchers
- R&D Expenditures
- Science and Engineering Articles
- Patent Application
- Trademarks

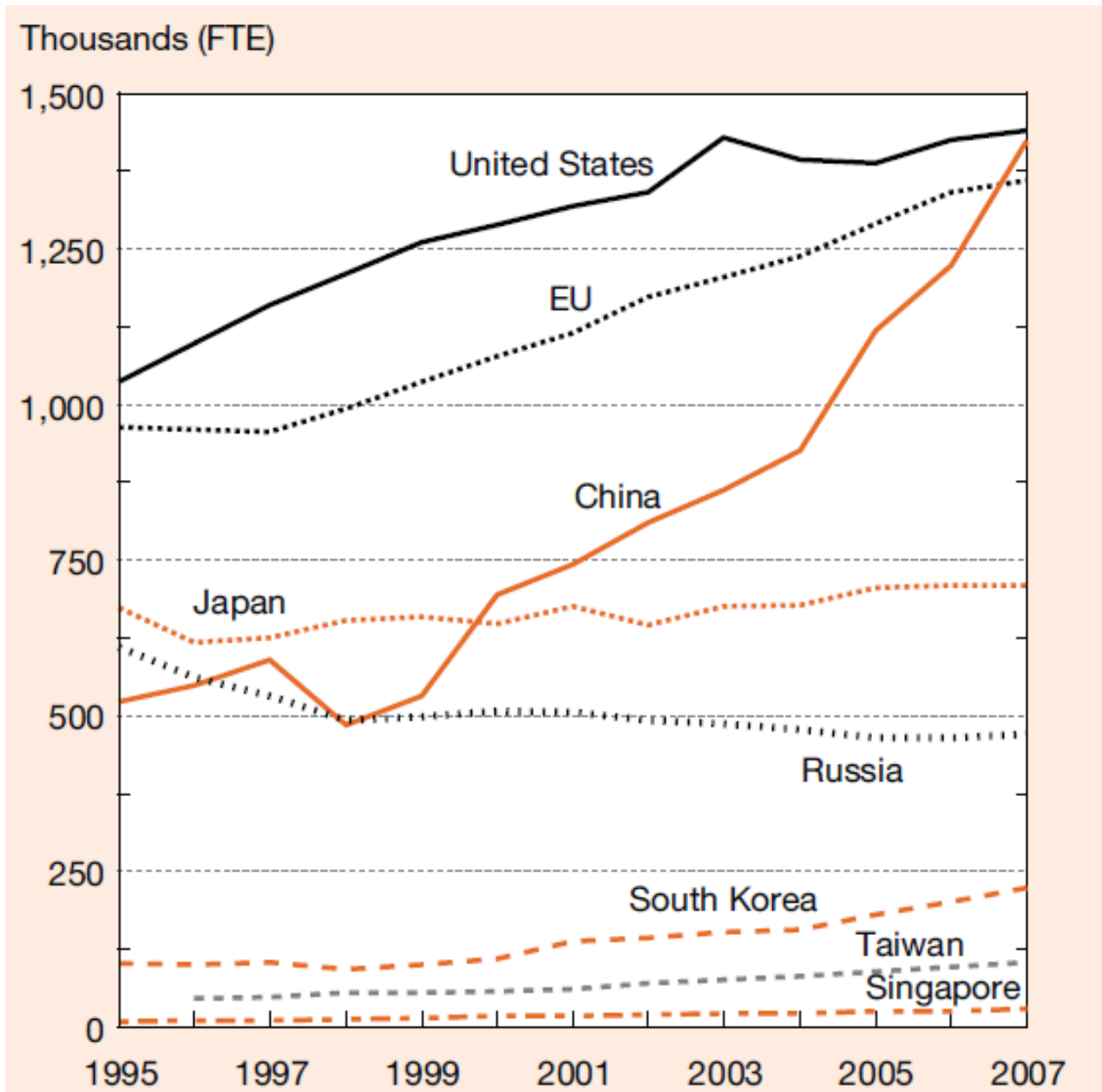
First Univ. Degrees in Natural Sciences, and Engineering 1998-2006



PhD Degrees in Natural Sciences & Engineering



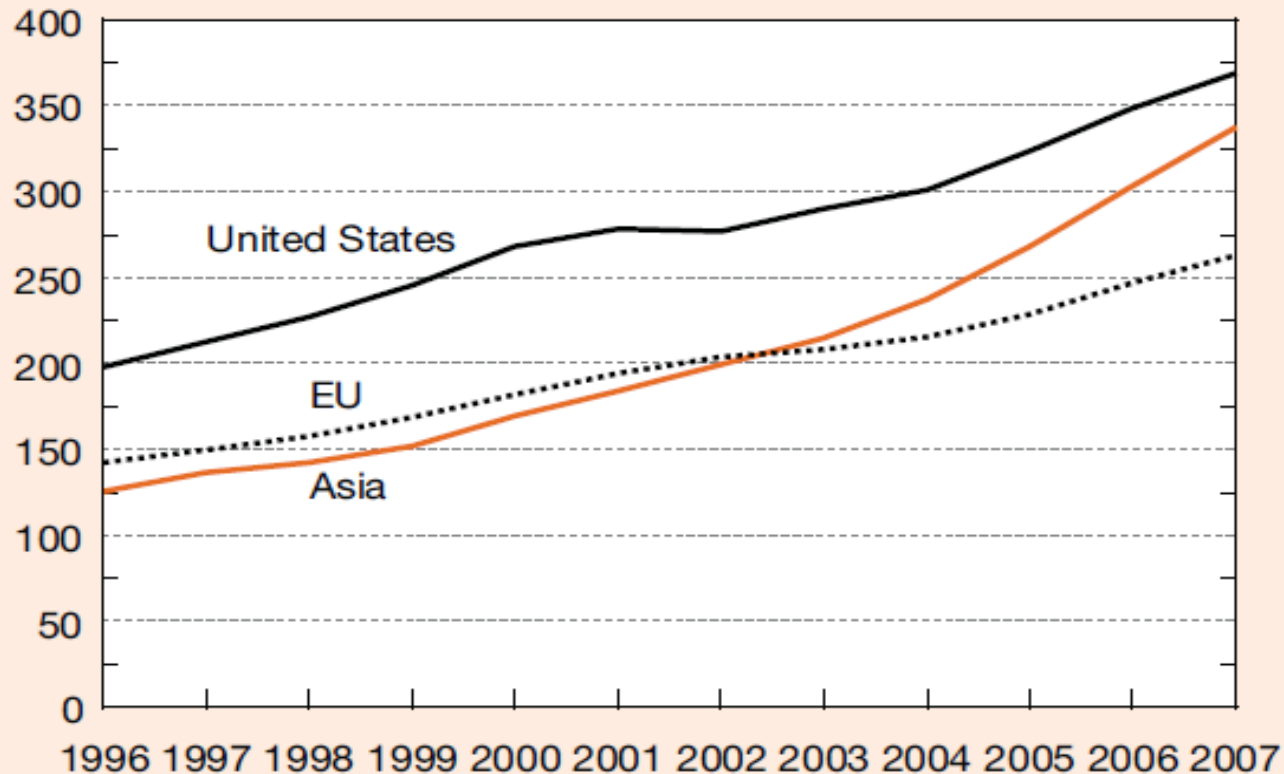
Researchers 1995-2007



Changing Expenditures on R&D

R&D expenditures for United States, EU, and Asia: 1996–2007

Dollars (billions)



EU = European Union

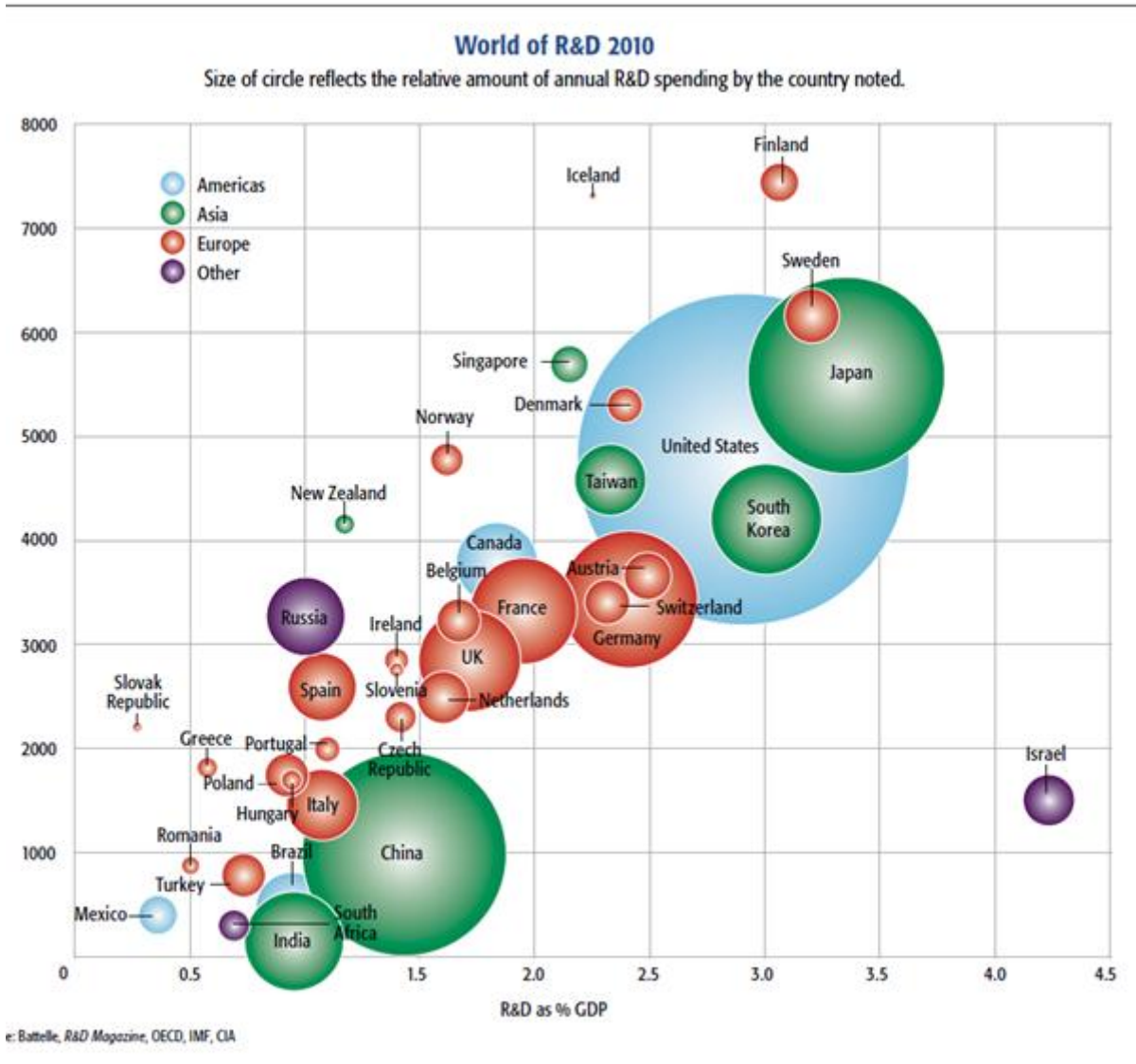
NOTE: Asia includes China, India, Japan, Malaysia, Singapore, South Korea, Taiwan, and Thailand. EU includes all 27 member states.

Gross Expenditures on R&D in PPP by Country and as Percentage of Global Expenditures 2010.

Country	2010 GERD in PPP	As Percent of World Total	As % of GDP of each country
1. United States	395.8	34.4	2.8
2. China	141.4	12.3	1.4
3. Japan	142.0	12.3	3.3
4. Germany	68.2	5.9	2.4
5. South Korea	42.9	3.7	3.0
6. France	41.5	3.6	1.9
7. United Kingdom	37.6	3.3	1.7
8. India	33.3	2.9	0.9
9. Canada	23.7	2.1	1.8
10. Russia	22.1	1.9	1.0
<i>Rest of world</i>	202.4	17.6	<u>na</u>
World Total	1,150.6	100.0	<u>na</u>

Source: Battelle (2010), p. 5

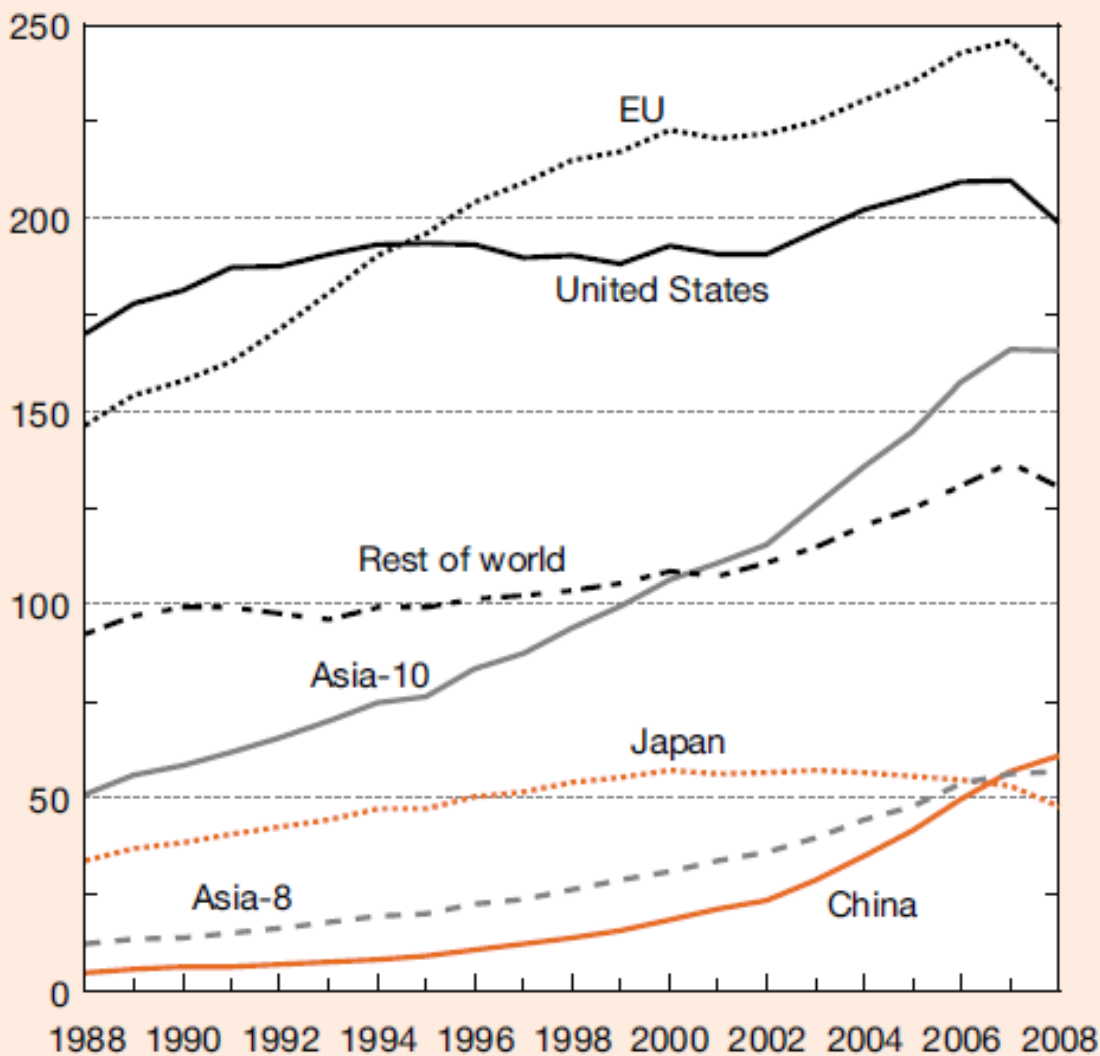
The R&D Input Landscape



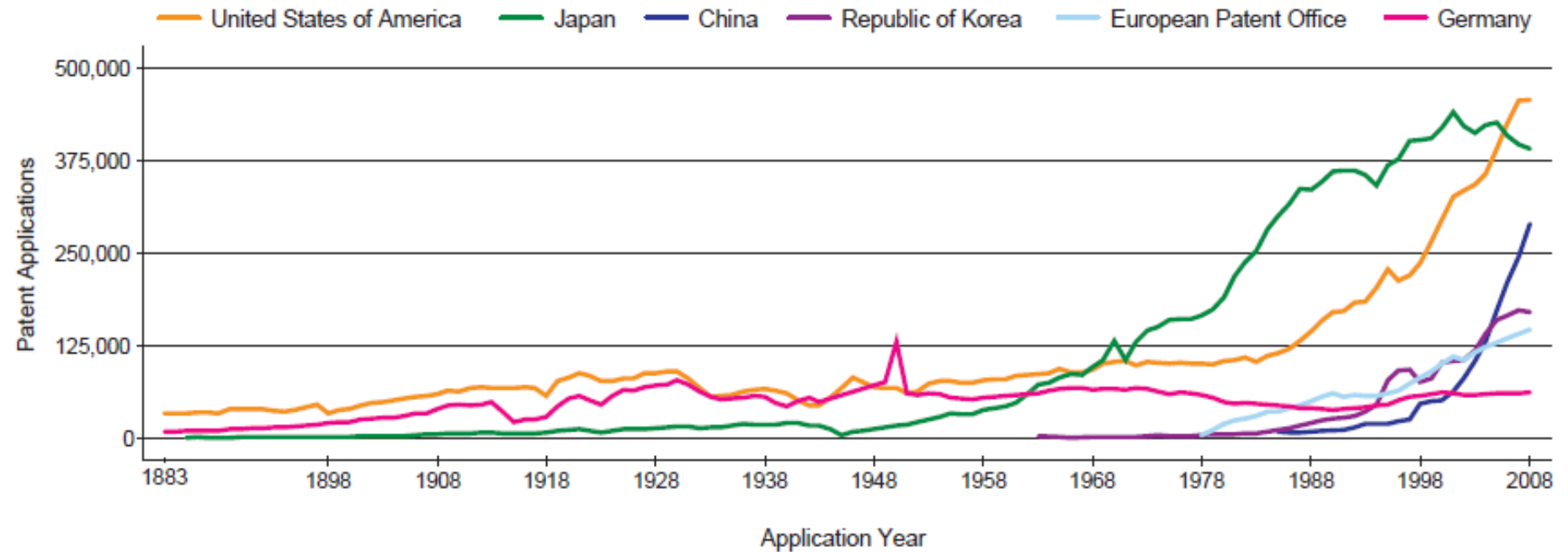
Science and Engineering Articles

S&E journal articles produced by selected regions/
countries: 1988–2008

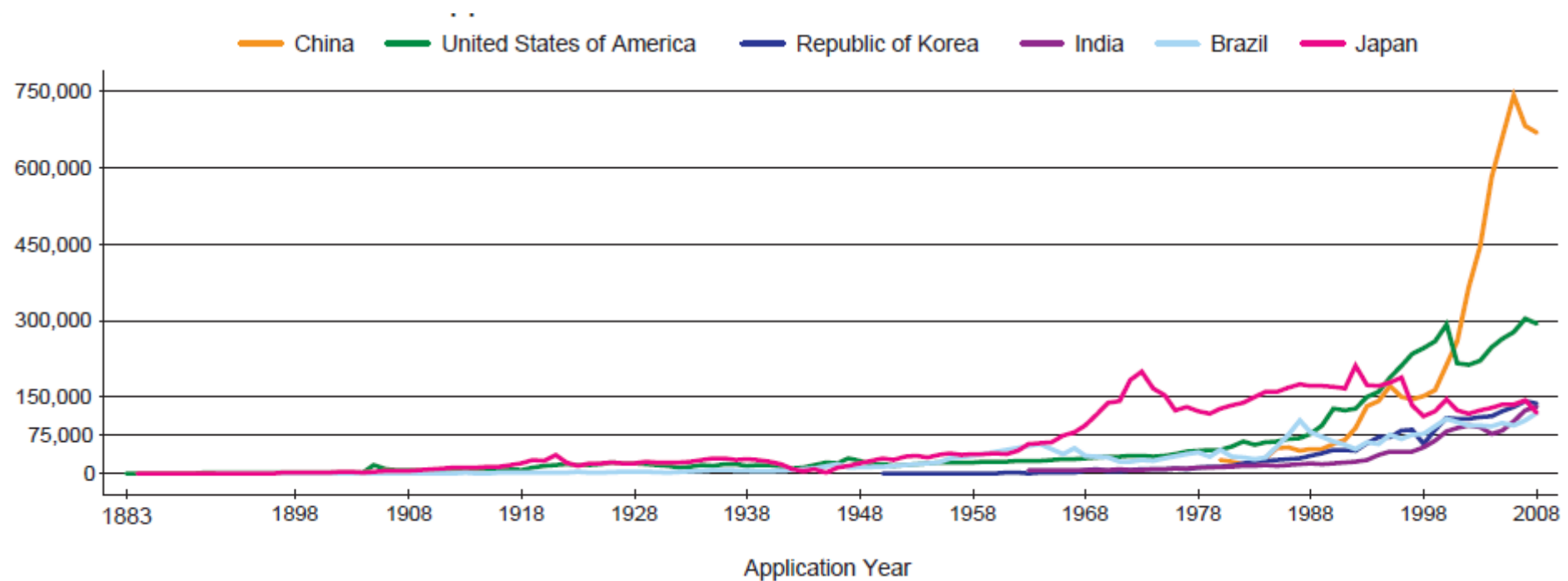
Thousands



Patent Applications Top 6 Offices 1883-2008



Trademark Applications Top 7 Countries 1883-2008



3. The National System of Innovation

- ***Narrow Innovation System***

- Universities
- Researchers
- Universities R&D labs
- Public R&D labs
- Firms and firm R&D labs
- Regional Innovation Systems (RIS)
- Science Parks and Industrial Clusters
- Networks among the above and between them and foreign correlates
- Angel, venture capital and early stage finance for technology start-ups
- Technology infrastructure (MSTQ, norms and standards)
- Government policies aimed explicitly at the narrow innovation system (R&D funding and subsidies, IPR, etc.)

- ***Broader Context of Innovation System (Enabling Environment)***

- Market size, sophistication, and growth
- Economic and firm structure
- Trade policy and domestic competition
- People & labor force, and their level of education & skills
- The education and skills development systems
- Entrepreneurship and risk taking culture, and quality of life
- Financial system including banking and equity markets
- Investment climate-macro conditions , ease of operating a business
- Infrastructure including especially ICT infrastructure
- Quality of life
- Government policy that affects factor and market conditions, economic and firm structure, infrastructure, and how all these interact in the enabling environment

4. The Global Innovation System

Global Networks Cutting Across National Innovation System

1. Trade in Goods and Services
2. Activities of Multinational Companies
3. Activities of other international organization (international agencies and NGOs)
4. Global Research Networks
5. Global Information and Communication Networks
6. Global Diaspora Networks
7. Global Flow of People: travel, international consultancy, immigration
8. Global Education Network:, students abroad, faculty exchanges & distance education

Country National Innovation Systems

Country 1 National System	Country 2 National System	Country 3 National System	Country 4 National System	Country 5 National System	Etc.
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5. Transnational Companies are the Key Global Innovation Agent

- They account for more than 60% of all R&D in world
 - Less of basic research
 - Most of the development and commercialization
- They account for 2/3rds of world trade
 - Half is intra firm trade between affiliates
 - Other half is with third parties
- They account for more than 27% of global value added
 - Underestimate because does not include backward and forward linkages
 - They control global supply and distribution chains
 - They are scouring globe seeking talent and markets, and competing based on innovation, scale and speed.
- Therefore they are key agent that needs to be taken into account in developing effective knowledge strategies
 - They have become global corporations, losing allegiance to home countries in pursuit of profits
 - Countries need to find productive way to engage with them to leverage their technological capabilities
 - MNCs also need to be enlisted in efforts to provide innovations relevant for the poor, as well as to address global public goods, particularly global warming

Total R&D and Percentages by MNCs & other Firms vs. Government and Others

Total	\$982	Percentage	100.0
Top 1000 MNCs	492.0		50.1
Next 1000 MNCs	36.3		3.7
Smaller MNCs and other companies	85.7		8.7
Government, non-profits, other	369.2		37.6
[Memo: top 20 MNCs]	[\$128.5]		[13.1]

Sourced: Jaruzelski and Dehoff (2008)

6. Lessons from China

- High growth of China has been due to
 - High investment in physical and human capital
 - Combined with very effective policies at tapping global knowledge
 - Formal methods
 - Informal methods
- In 2006 China decided to go beyond technological catch-up to indigenous innovation
 - Massive investments in R&D and expansions of high level human capital for R&D
 - Goal of increasing R&D/GDP to 2.2% by 2015 and 2.5% by 2020
 - Has targeted virtually all high technology areas
 - Has also targeted alternative energy and is likely to become leader
- However
 - Not clear it is getting innovative outputs commensurate with rapid increase in inputs
 - It will still need to make effective use of global knowledge-had to back off from strong focus on indigenous innovation
 - An open question is to what extent China will be successful in developing radical innovations under an authoritarian regime.

7. Implications for Advanced Countries

- Opportunities

- For TNCs—locate more R&D in emerging countries to take advantages of high level and lower cost researchers and growing technological infrastructure
- For TNCs—innovate for the needs of rapidly growing markets in emerging countries
- For Governments—international cooperative programs with growing innovative capacity of emerging country governments

- Challenges

- For firms—more competition from growing innovation capability of firms from emerging countries
- For governments—TNCs from their countries putting more resources into emerging markets including innovation activities which strengthens the innovation capacity of those countries

8. Implications for Developing Countries

- Opportunities

- More diversified sources of innovation which may be better suited for their needs
- Growing markets for them

- Challenges

- Greater competition in manufacturing and services
- Hard to keep up and make effective use of all the new innovations.
 - While some countries may be able to take advantage of this
 - Many of poorest developing countries are falling further behind because they do not have the educational and technical capabilities to take advantage.

9. Challenges and Opportunities for the Global System--Challenges

- Increasing competition from emerging countries, particularly now that advanced countries have sluggish growth and persistent high unemployment may to protectionist reaction
- Risk of increasing frictions over research and IPR due to very successful technological catch-up strategies of emerging countries and free-riding on basic research funded by developed countries
- Growing inequality with-in and across countries

9. Challenges and Opportunities for the Global System--Opportunities

- For challenges noted above
 - Diffuse trade frictions by rebalancing between surplus and deficit countries
 - More investment in basic research and in respecting intellectual property by new large emerging countries
 - More action on redistributive policies with-in countries an across countries
- Take advantage of innovation capability of emerging countries to address major global challenges
 - Climate change and alternative energy
 - Water security
 - Food security
 - Global disease pandemics

10. Conclusions and Implications for Policy

- The innovation landscape is much more complex and interdependent
- There is much more competition as result of greater capability in other countries, particularly in Asia
- Countries are competing more in the innovation sphere
- Besides setting up supportive national innovation systems they are competing:
 - To get more value out of their investments in R&D
 - To attract/retain the higher value activities of MNCs
 - To produce retain and attract top talent
- They also need to develop better global governance systems regarding trade, industrial, and innovation strategies
- There is also need to develop cooperative public goods oriented innovation programs to tackle global challenge such as climate change.