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INTERPLAY OF NIS AND CORPORATE R&D IN ASIA

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Contents

Global Innovation System (GIS)

- Global innovation system (GIS) is made up of national innovation systems (NISs) and corporate R&D systems, or corporate innovation systems (CISs), around the world
- If a system can be called an ecological system, it should have the following characteristics :
  - Diversity of species
  - Open system
  - Interaction among actors and feedback system
  - Co-evolution
  - Self-selection process (survival of the fittest)

Globalization of NIS ?

정구현

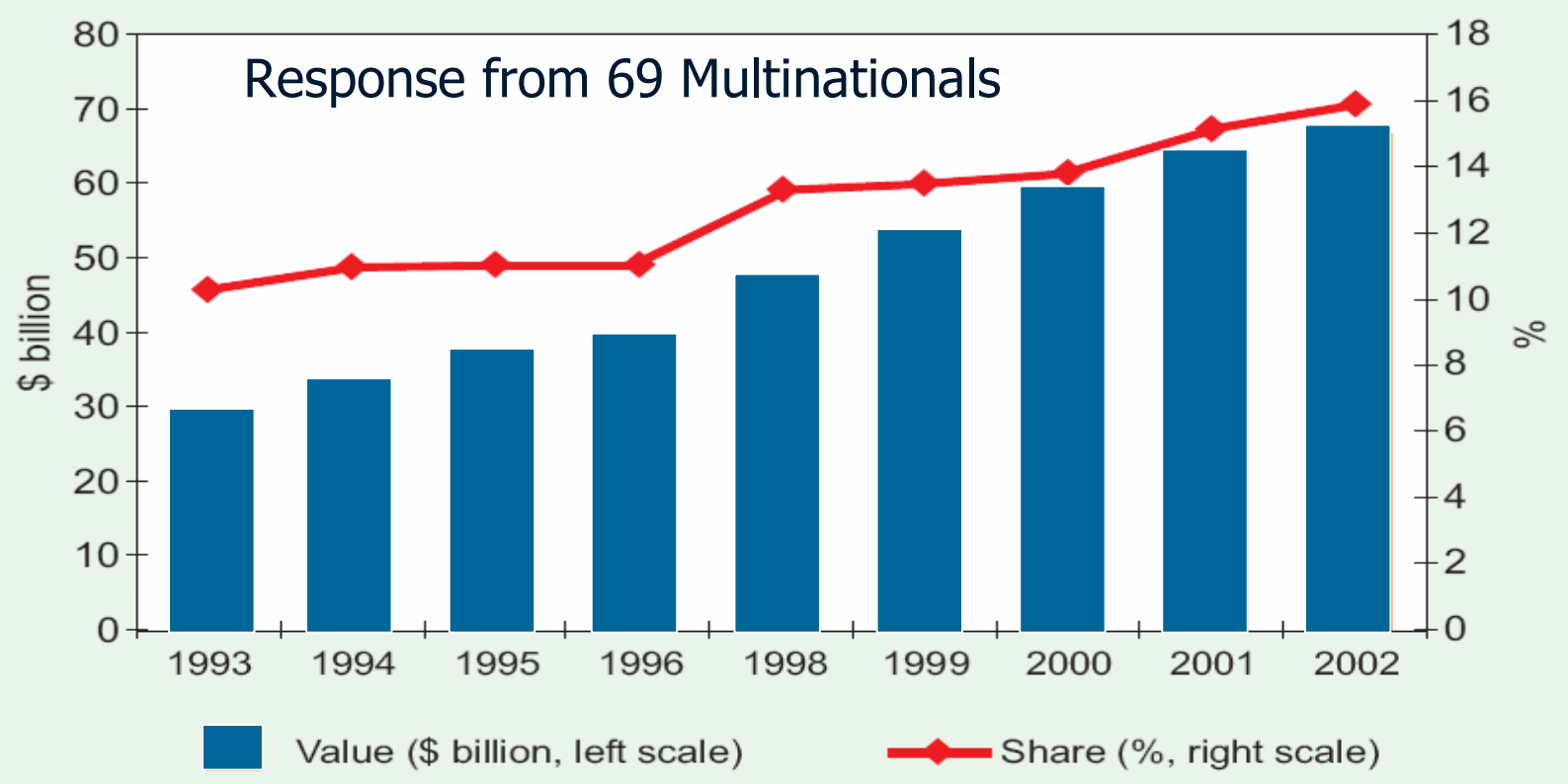
- **Evidence from Empirical Studies (Carlsson)**
  - (1) There is a wide difference among countries in the rate and type of globalization.
    - Japan, the U.S.-Canada and the EU
  - (2) The measures of internationalization are in the 10~30% range as compared with national stocks.
    - In terms of corporate R&D, strategic alliances, technology transfer, flows of science & technology personnel
  - (3) Basic science and university research are much more global than applied research and corporate R&D.
  - (4) While NISs are becoming more intertwined, national science policy and networks still play a crucial role.

정구현1 Bo Carlsson, "Internationalization of innovation systems: A Survey of the Literature," Research Policy, 35(2006), 56-67.
정구현, 2006/08/29

Corporate R&D

- The degree of internationalization of CIS has slowly increased over the last decade.

R&D Expenditure by Foreign Affiliates in 30 Economies



Source : UNCTAD, 2005 World Investment Report

Globalization of Corporate R&D?

- Nature of foreign R&D activity by MNEs
  - tends to be less science-based than the R&D conducted at home
  - tends to be in fields outside the companies' core competence
  - is largely conducted within corporate networks
- Corporate R&D is becoming global, but remains largely intra-firm.

Global Innovation Ecosystem?

- **Is it 'global'?**
  - It is becoming much more international, but NISs are still very much national and corporate R&D systems are mostly intra-firm.
- **Is it an 'ecosystem'?**
  - NIS tends to be of stand-alone type. (closed)
  - CIS is becoming global, but interaction among different CISs is quite restricted due to the proprietary characteristic of corporate research. (little interaction)
- How much interaction between NIS and CIS?

Contents

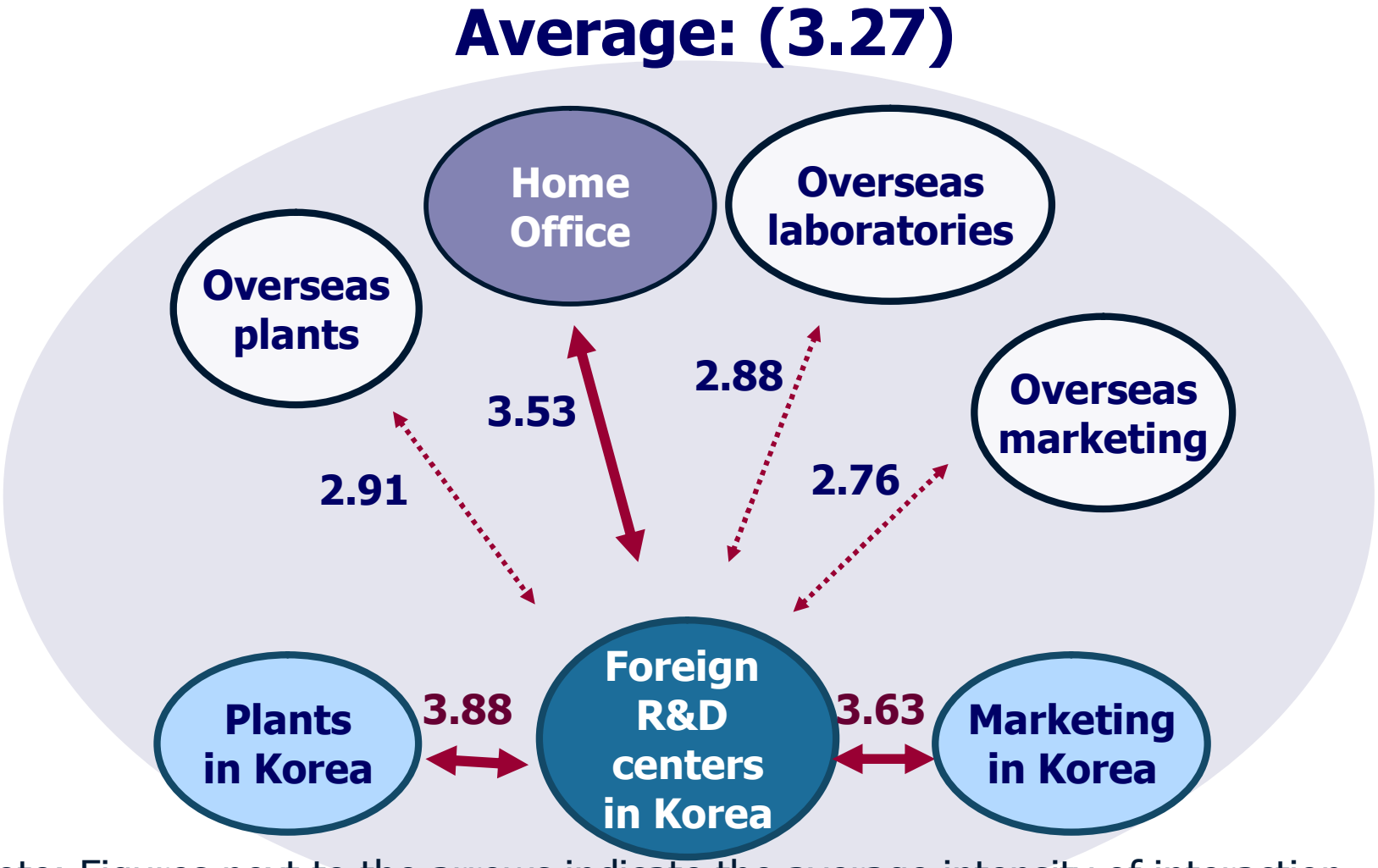
Interplay of NIS and CIS in Korea

Survey Results

- **Mail Survey(2005)**
- **Population**
  - **407 foreign-owned research labs in Korea (more than 10% foreign ownership)**
- **Sample**
  - **76 respondents**
- **Key Findings:**

- Foreign R&D centers are more interested in business development than in technology development.
- They interact very little with local technology clusters.

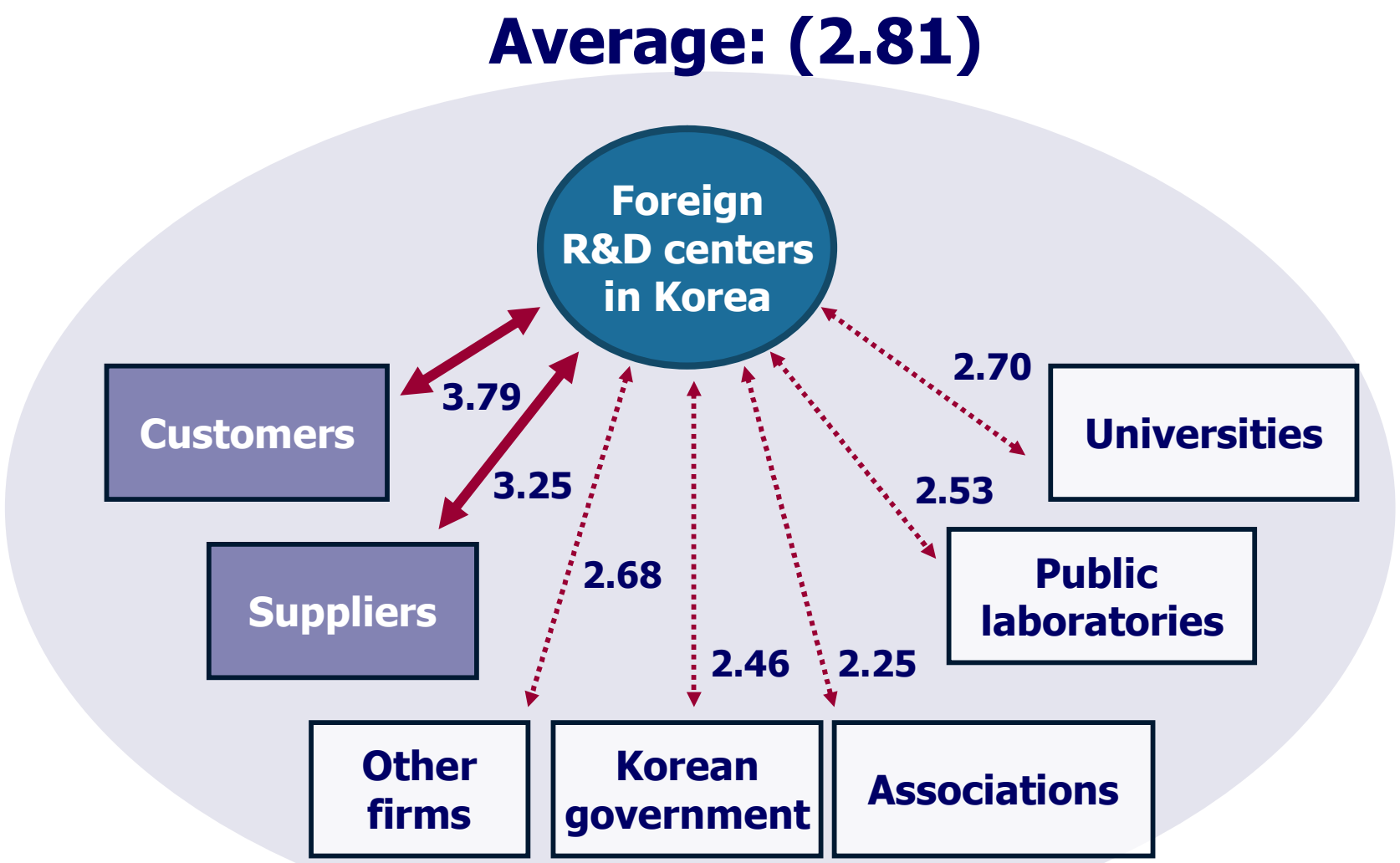
Intensity of Intra-firm Interaction



Note: Figures next to the arrows indicate the average intensity of interaction.

Note: Intensity of interaction ranges from 1 (low) to 5 (high)

Intensity of Intra-nation Interaction



Note: Figures next to the arrows indicate the average intensity of interaction.

Note: Intensity of interaction ranges from 1 (low) to 5 (high)

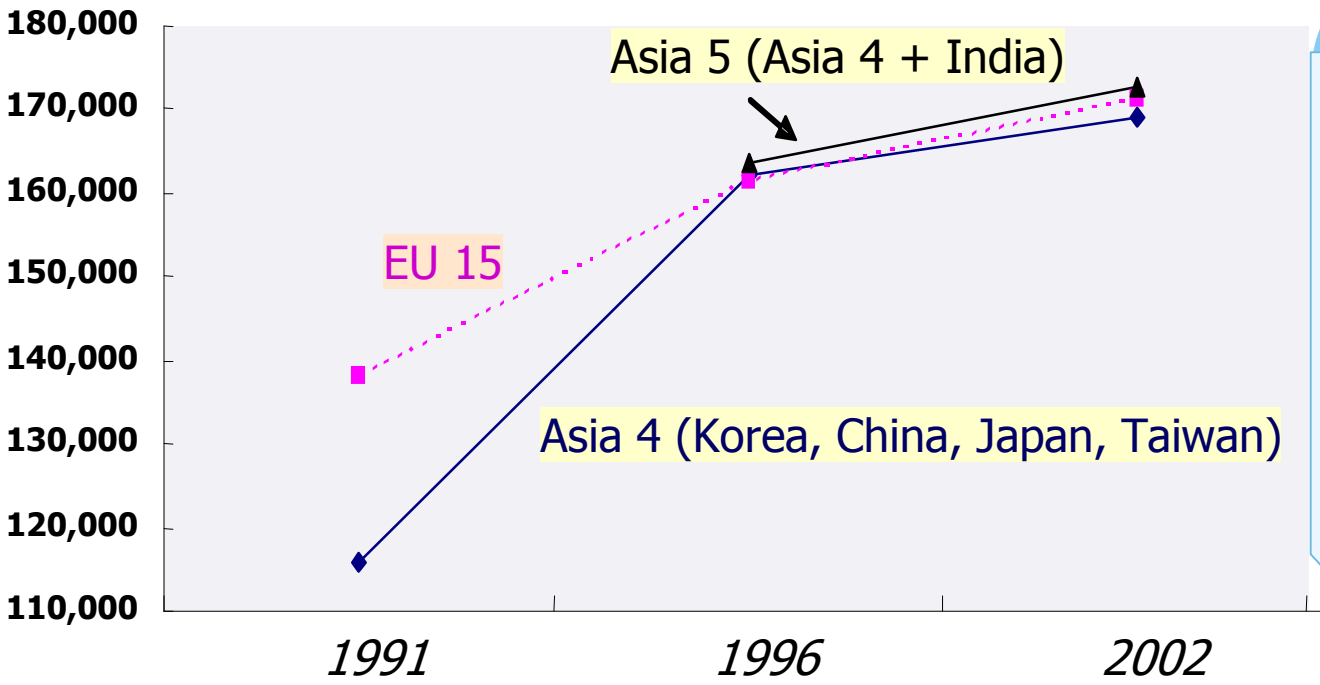
The Reason for Inactive Intra-Nation Interaction

Q: What's the reason for inactive external interaction?

Note: The data are compiled from respondents' multiple answers.

Gross R&D Expenditures in East Asia

- NISs in East Asia are spending a large amount of money on R&D, which is comparable to EU 15.



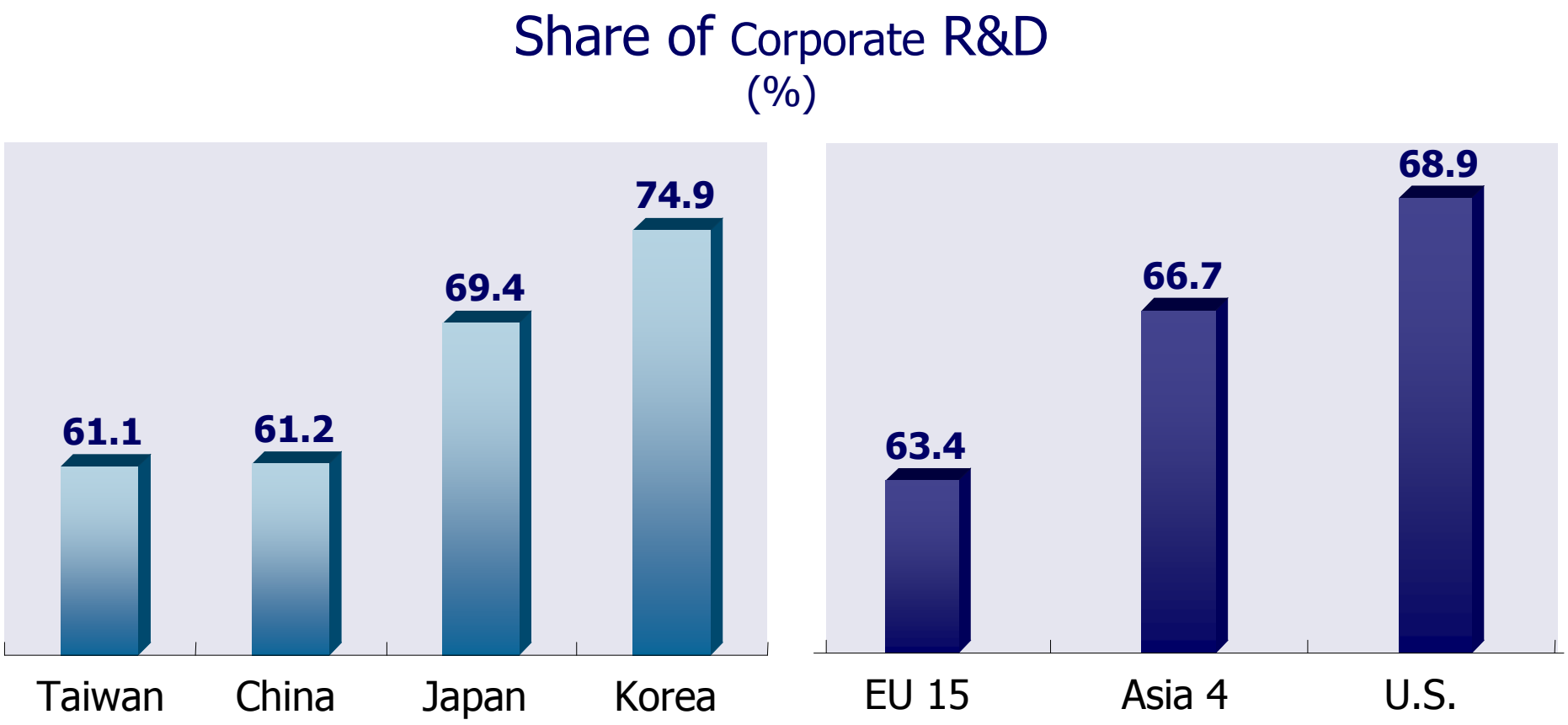
R&D/GDP (%, 2003)

- Japan 3.15
- Korea 2.64
- Taiwan 2.45
- China 1.44 (2004)
- India 0.84 (2001)

Source : UNCTD, *World Investment Report 2005*

Corporate R&D in East Asia

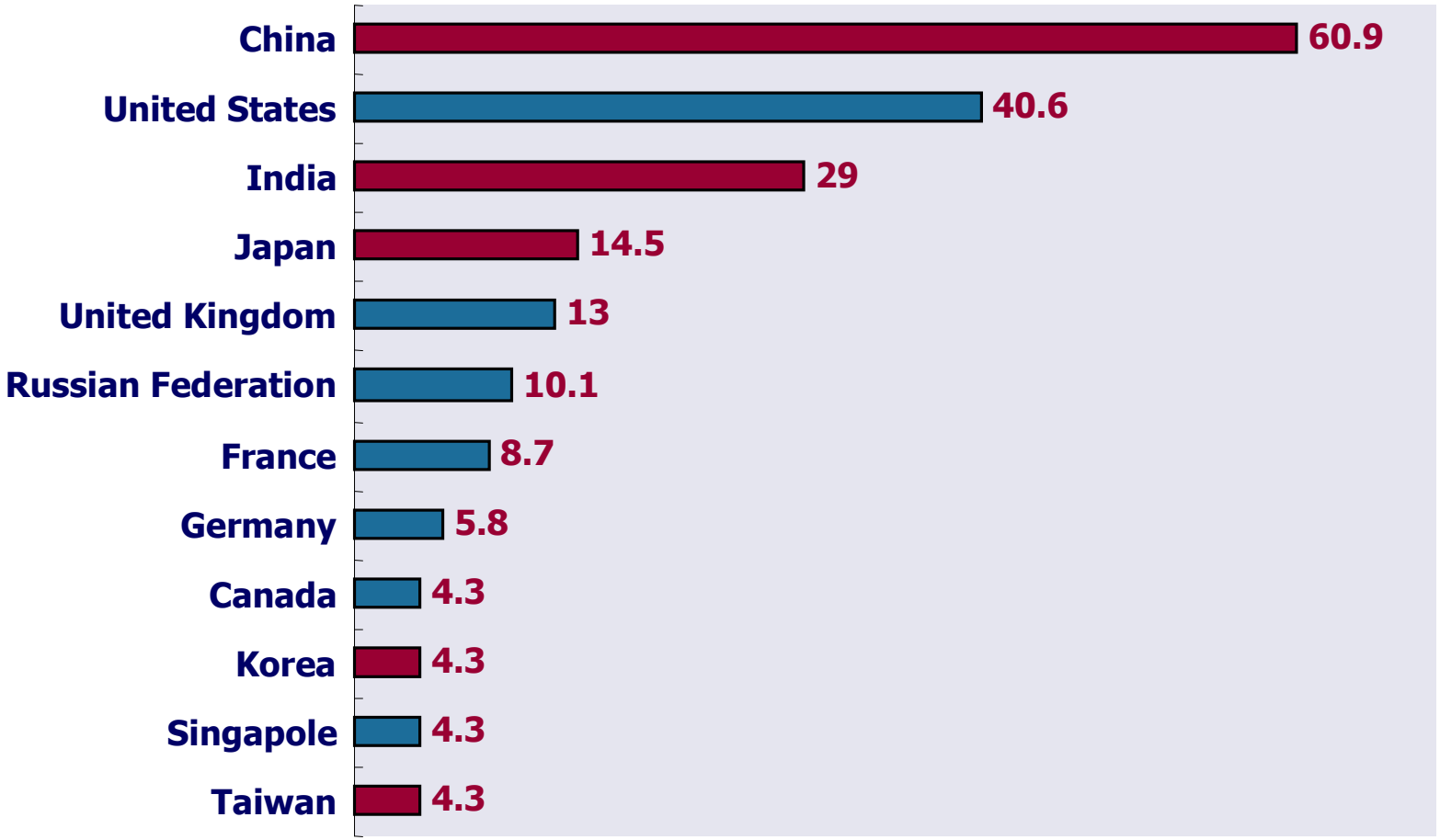
- Share of corporate R&D in national R&D expenditures is proportionately high in East Asia.



Source : UNCTD, *World Investment Report 2005*

East Asia is becoming more attractive to MNEs.

Most attractive prospective R&D location



Source : UNCTD Survey on the Internationalization of R&D, 2005

Developments in China's NIS

- R&D expenditures are growing, but are still low in relative terms, especially in business sector.
- Structure of innovation system improving, but low productivity
  - Universities account for a small share of national R&D.
  - Government research institutes are slow in adjusting to market incentives.
  - Industry's innovative output is low compared to R&D inputs.
- Education system promises to be source of research workers in the future
  - 61% of undergraduates are in science and engineering.
  - Graduate enrollments are increasing.

Source : Jerry Sheehan(2004), OECD Science & Technology Policy Division

R&D by Multinationals

- **Main Drivers : Huge Market & Human Resources**

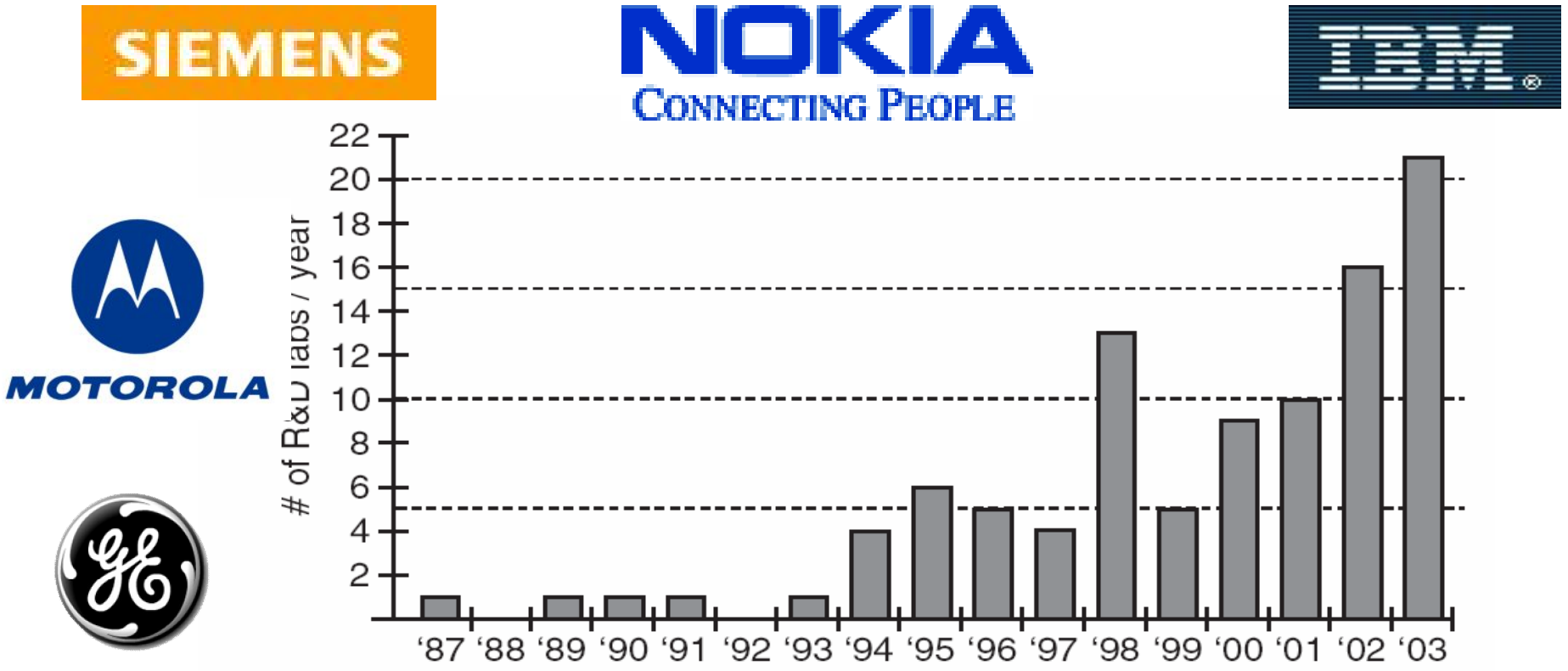


Figure 1. Number of new R&D labs in China set up by MNCs between 1987 and 2003 (Source: STS, 2003, and own research).

Source : Zedtwitz, Max von(2004)

Interplay of NIS and CIS: a different picture in China

- Multinational R&D centers hold a majority in 'Excellent R&D centers' in China.
  - 20 Multinationals among 25 Excellent R&D centers selected by '*Global Entrepreneur*' magazine
- 16 Excellent Multinational R&D Centers are conducting R&D projects aiming for world market.
  - intel China : Basic System Software, Translator

- Collaborative R&D Relationships with Chinese University.
  - 97 Multinationals have 202 R&D projects with 36 Universities, e.g. Siemens-Shanghai Jiao Tong Univ.

Contents

China's National Innovation System

China's Technology Strategy in the past

China's R&D strategy in the future

'Indigenous Innovation (自主創新)'

<2005~2020>

'Self-Initiated Innovation'

ex) Acquisition of advanced foreign companies, expansion of R&D activities, development of own technology

<2020>

Long-term R&D Strategy Target

- R&D/GDP : 2.0% (2010), 2.5% (2020)
- Share of Government R&D : 40%
- Dependence on Foreign Technology : under 30%

National Innovation System in India

- **Small amount of R&D expenditure**
  - –$ 3.7 billions (2001): less than 1% (0.84) of GDP
- **Low level of corporate expenditures on R&D**
  - –Corporate expenditures on R&D in 2001 : 851 millions of $
  - –Share of corporate R&D in total R&D : 23 %
- **A large number of science and engineering graduates**
- **Multinationals set up software development centers in India**:
  - –Over 100 R&D centers in India
  - –By the crude measure of patents earned by the Indian subsidiaries of multinational firms, a significant amount of innovation now stems from India.

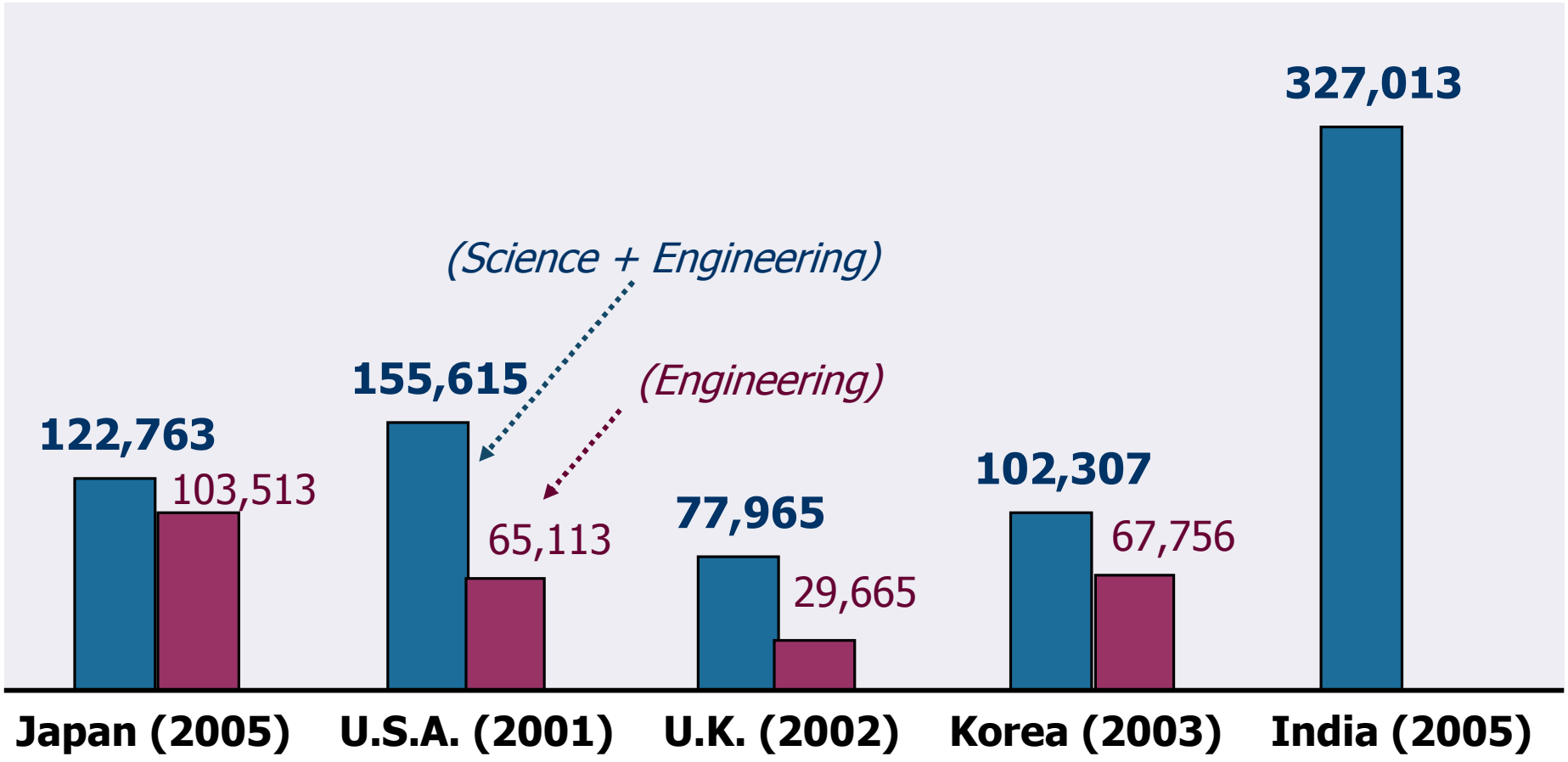
India's Competitive Strength: Human Capital

- India's competitive edge - its skilled manpower and entrepreneurial expertise
  - Over 380 universities and 11,200 colleges
  - 1,500 research institutions
  - Over 200,000 engineering graduates
- Knowledge workers in software industry increased from 56,000 in 1990-91 to over 1 million by 2004-05
- 54% of India's population under 25 years of age
- will account for 25% of the global growth of working population over the next 5 years.

Source : Dr. Ajay Dua (2005), Ministry of Commerce & Industry, India

India's Human Resources

Science and Engineering Undergraduates



Contents

UN Millennium Development Goals

1. Eradicate extreme poverty and hunger
2. Achieve universal primary education
3. Promote gender equality and empower women
4. Reduce child mortality
5. Improve maternal health
6. Combat HIV/AIDS, malaria and other diseases
7. Ensure environmental sustainability
8. Develop a global partnership for development

Realizing these goals are not so much dependent on technology but more on political will and system!

Example #1

- Eradicating poverty globally requires a relatively small amount of resources, but the political and institutional problems are standing in the way of achieving such goals.

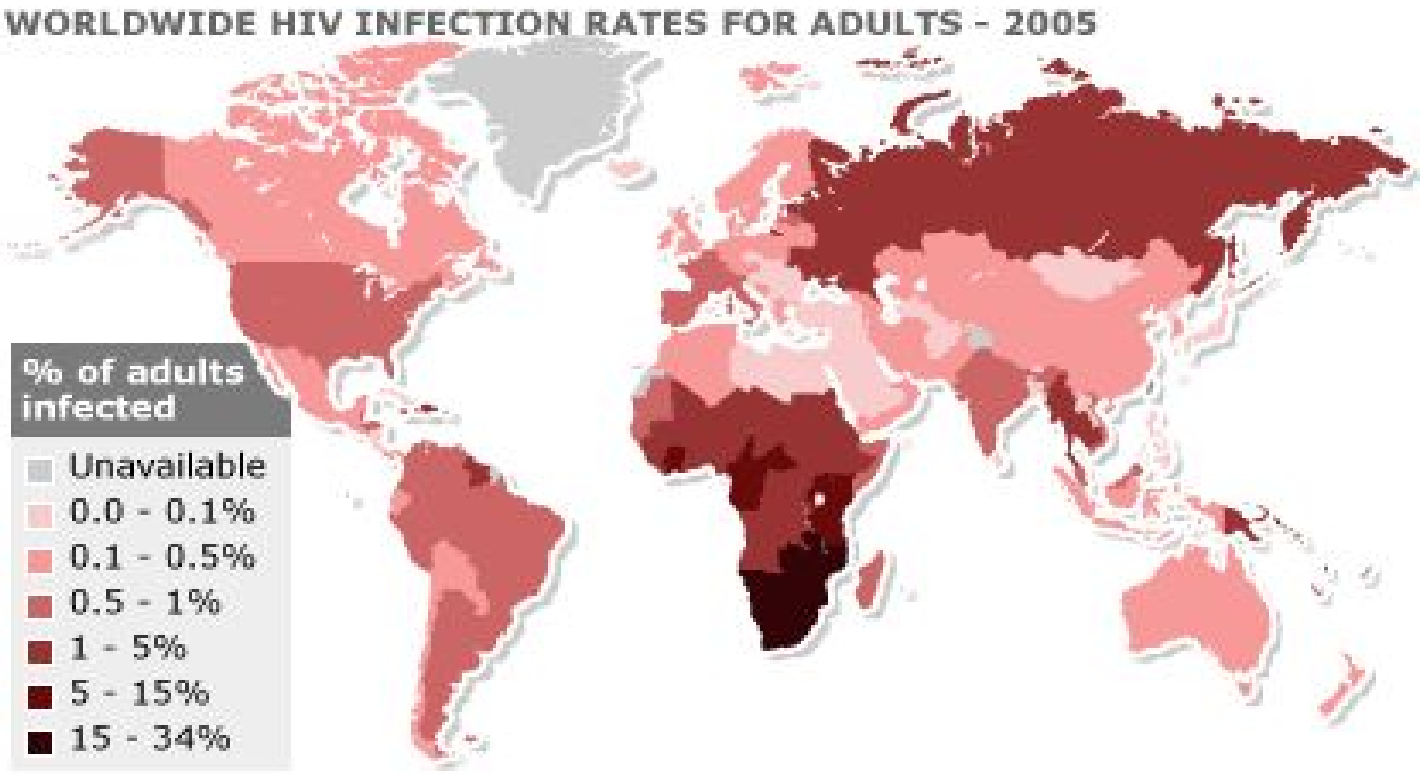
North Korea needs to import 2 million tons of rice per year.

It costs only 800 million dollars to import rice, including transportation costs.

And yet it is estimated that one or two million people died of famine in the middle of the 1990s.

Example #2

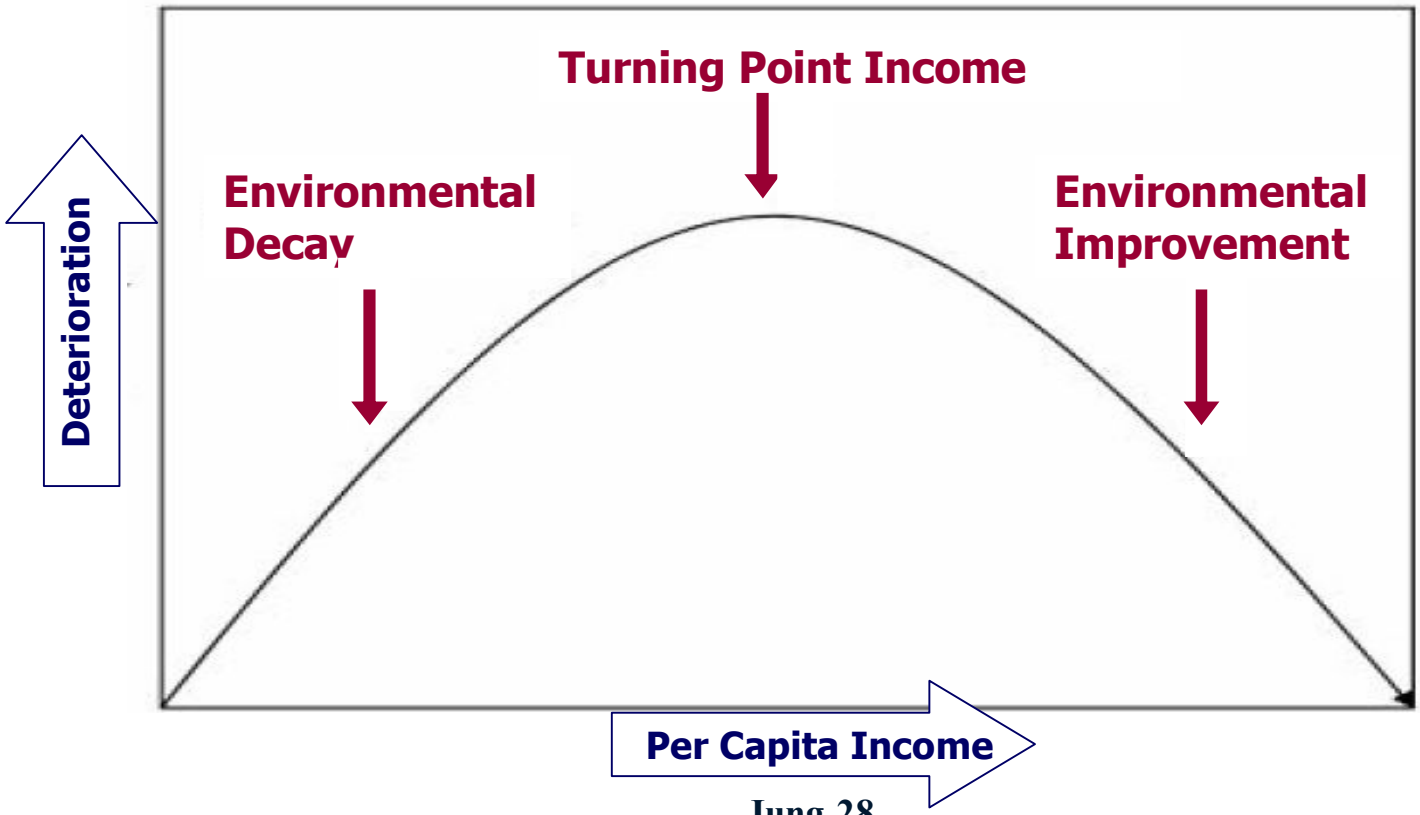
- In reducing AIDS, vaccine is not widely available to the highly infected region. And only 20% of 40 million AIDS patients in 2005 received proper medical treatment. (UNAIDS, 2006)



Example #3

- There is a positive correlation between economic growth and environmental quality, known as 'Environmental Kuznets curve'.

Environmental Kuznets Curve



Contents

Summary: Global Innovation Ecosystem?

- Both NIS and CIS tend to be a closed system rather than an open one, except for basic science area.
  - Technology is a source of competitive advantages for nations and companies.
- Corporate innovation systems are highly corporate-specific and not amenable for sharing knowledge.
  - Corporations are spending their R&D money to gain competitive advantages.
- The global innovation system is rather fragmented or compartmentalized.
  - There are many artificial and institutional barriers for the system to become an open system.

Summary: Interplay of NIS and CIS in East Asia

- In East Asian regional context, national innovation systems of four major players seem to have little interaction.
- There are two different types of interaction between NIS and CIS in Asia:
  - Self-contained type: Korea, Japan
  - Hybrid type: China, India
- The globalization is advancing more slowly in technology compared to trade, foreign direct investment or capital flows.