The Korean Innovation System

From Industrial Catch-Up to Technological Leadership?

International Conference
"Pathways to Innovation: Policies, Products, and Processes for Competitive Advantage in a Global Economy"
Nishogakusha University, Tokyo, May 20-21, 2005

Martin Hemmert

고려대학교 경영대학
Korea University Business School

Contents

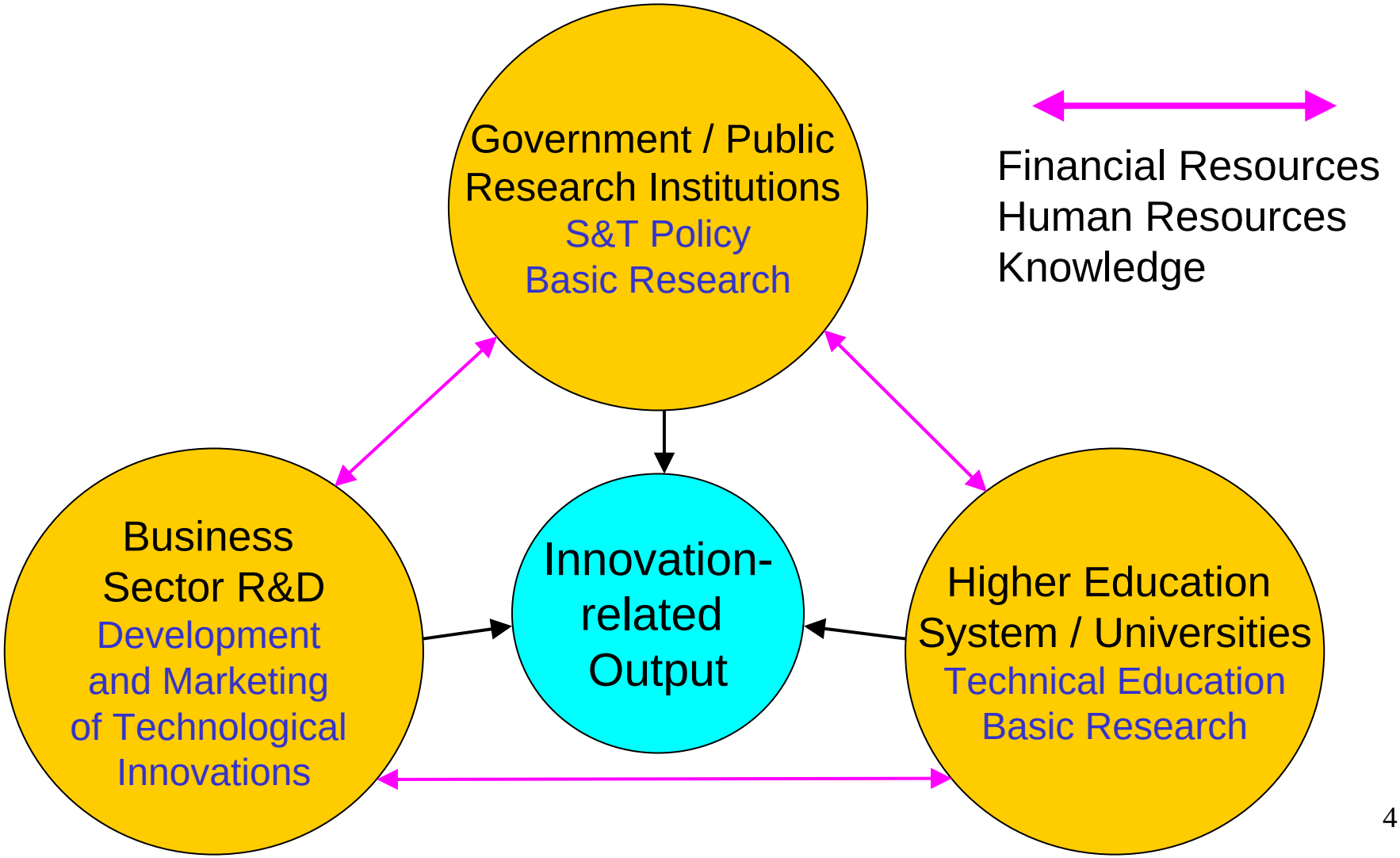
The Concept of Innovation Systems

Emergence of the Concept

- **Introduced** in the late 80s/early 90s
- Central Issue: **Need for systemic analysis** (overarching single institutions or organizations) to explain innovative performance
- **Multiple levels**: national, regional, sectoral innovation systems
- Various definitions; common ground: **Set of relevant institutions and the interaction between them**

The Concept of Innovation Systems

National Innovation Systems: A Simplified Model



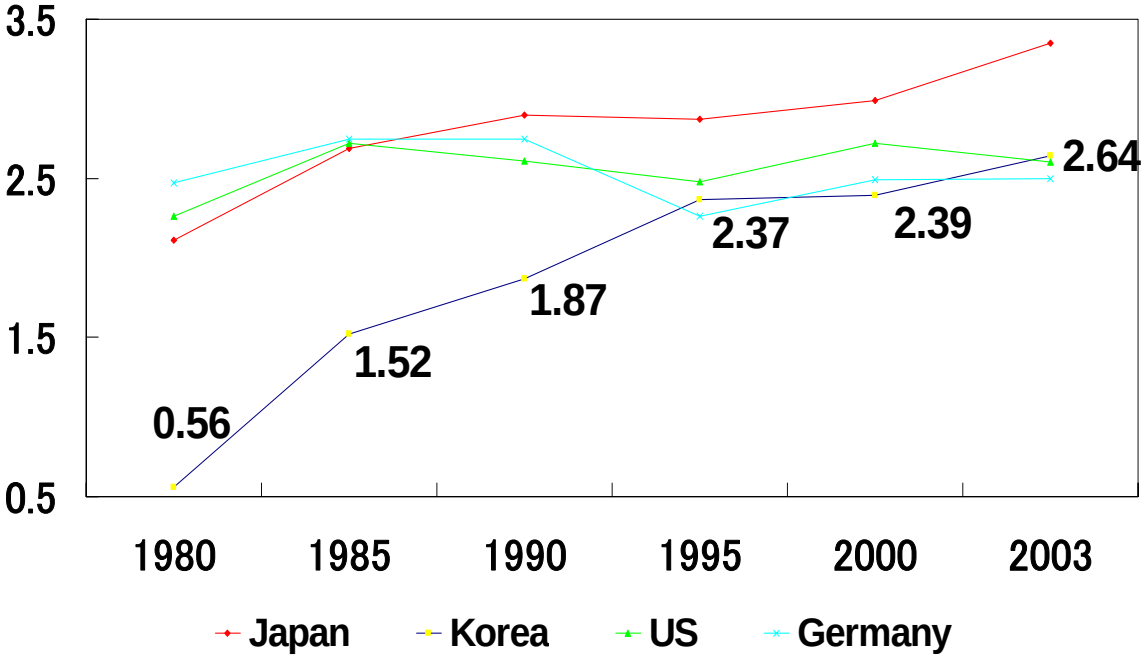
The Korean Innovation System: Overview

Major stages of development

- **1950s-1970s:**
  - Technological development through import of capital goods, formation of large firms, import substitution and export promotion
  - Very limited formal R&D activities
- **1980s:**
  - Formation of industrial R&D base
  - Heavy R&D investment by comglomerates (chaebols) to boost technological competitiveness
- **since the 1990s:**
  - Formation of basic research capabilities
  - Emphasis on international co-operation and exchange

The Korean Innovation System: Overview

R&D intensity of leading countries (% of GDP)



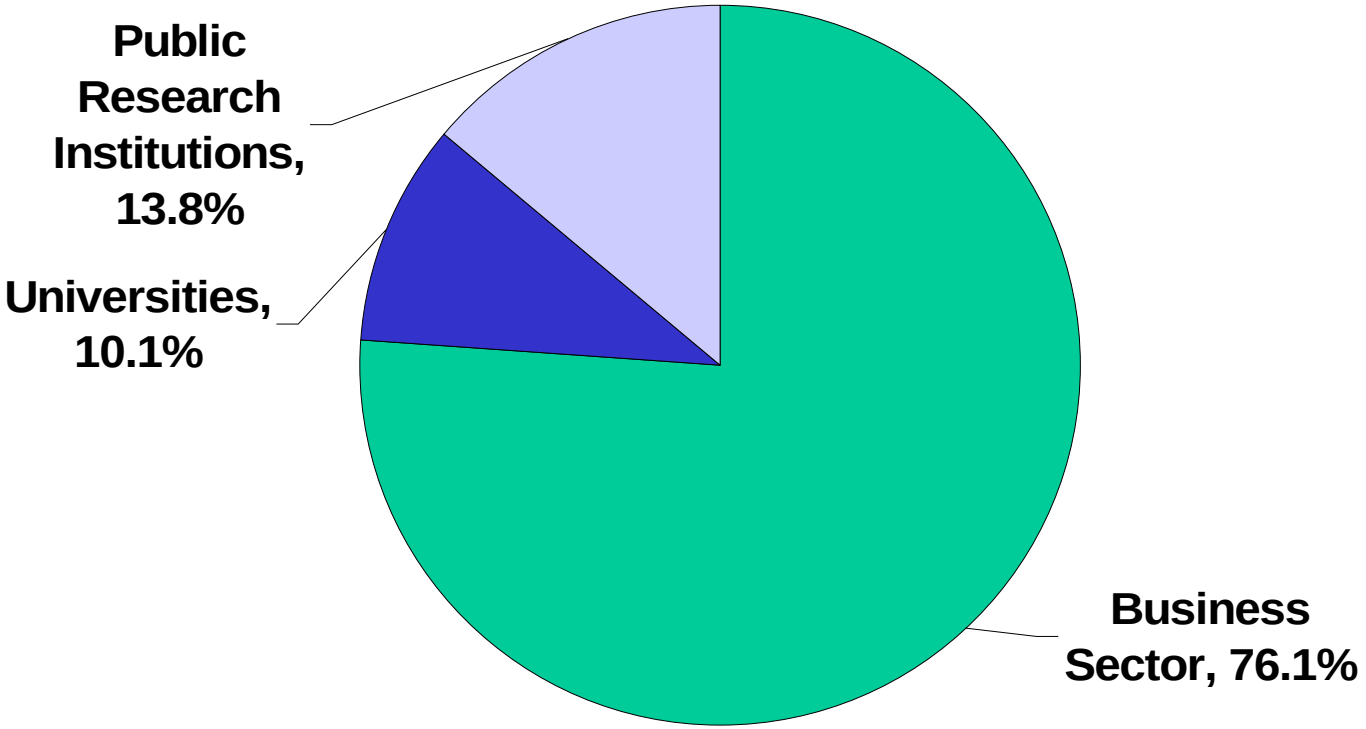
R&D expenditures per person, PPP US-$ (2003)

US	964.0
Japan	838.4
Germany	657.8
Korea	542.8

⇨ **Rapid catch-up to leading countries!**

The Korean Innovation System: Overview

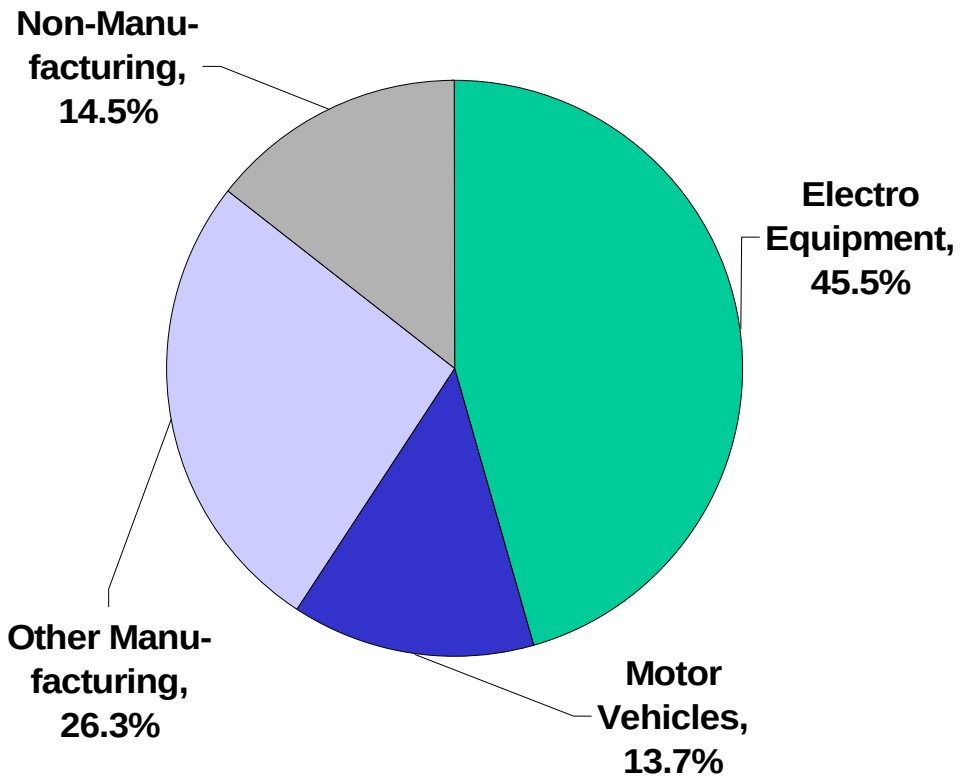
R&D expenditures by performing sector (2003)



⇨ **Heavy reliance on industrial R&D!**

The Parts of the KIS: Business Sector

Industrial R&D activities by industry (2003)

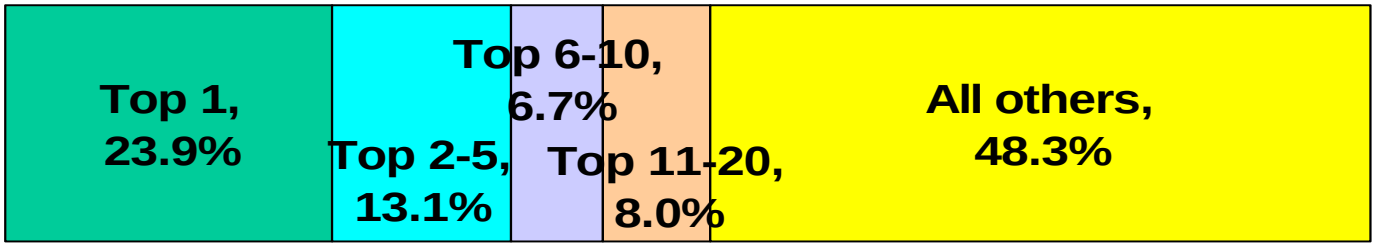


⇨ **High concentration on IT sector!**

The Parts of the KIS: Business Sector

Industrial R&D activities by firm size / type (2003)

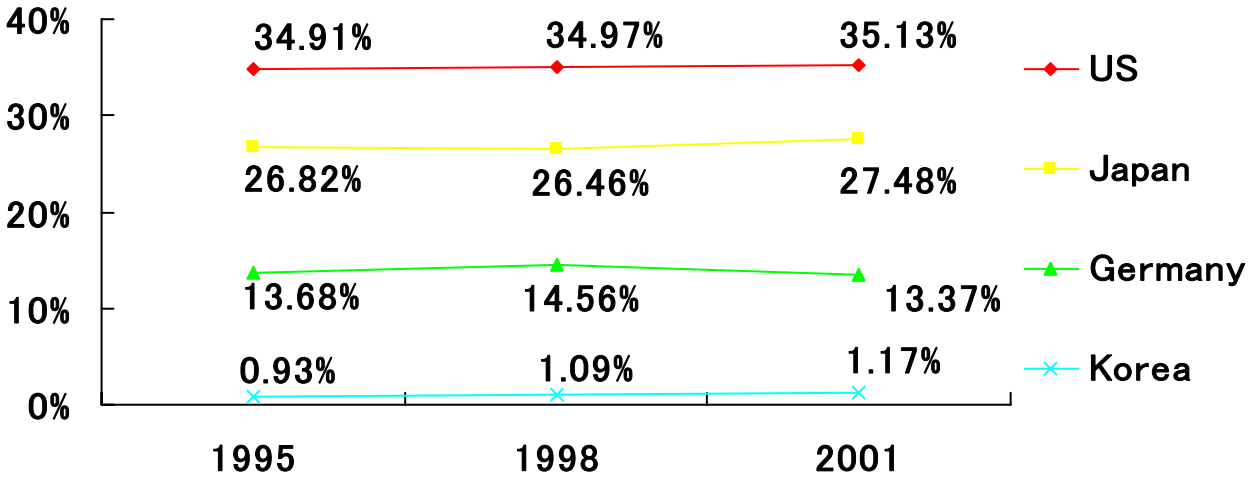
Concentration of industrial R&D activities (2003)



⇨ **Dominating role of leading large firms!**

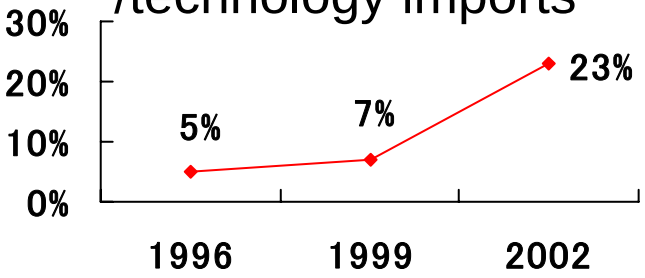
The Parts of the KIS: Business Sector

Global share of triad patent families

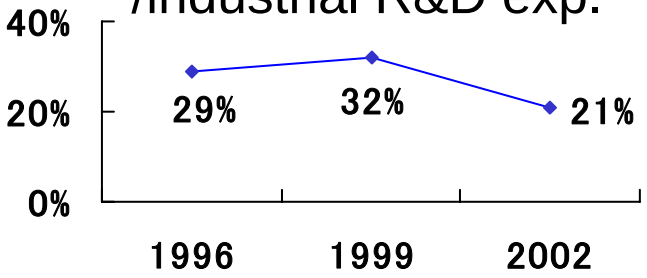


Still weak IP position…

Technology exports /technology imports



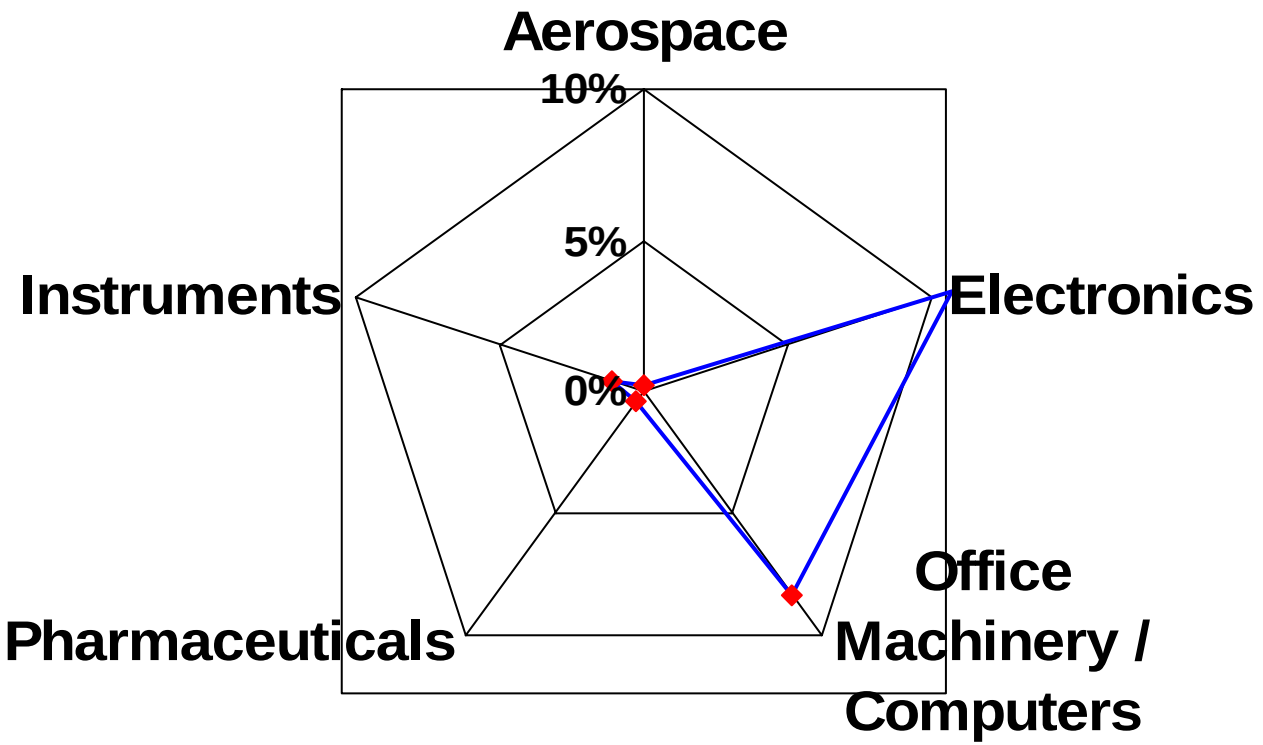
Technology imports /industrial R&D exp.



and strong reliance on foreign technology…

The Parts of the KIS: Business Sector

Global export market share in high tech industries (2001)



…but strong competitive-ness in some high tech industries!

The Parts of the KIS: Government and Public Research Institutions

Governmental R&D budget by ministry (2004)

Ministry of Science & Technology	20.5%
Ministry of Commerce, Industry & Energy	19.3%
Office for Government Policy Coordination	11.9%
Ministry of Defense	11.4%
Ministry of Education	11.1%
Ministry of Information & Communication	9.1%
Others	16.7%

- Highly fragmented S&T policy
- Increased priority of S&T policy since the 1990s
- Efforts to enhance structural change (e.g., large scale support for venture firms)

The Parts of the KIS: Government and Public Research Institutions

Structural data on research institutions (2003)

Type of institutes	Number of institutes	Number of researchers	Average number of researchers / institute	Proportion of governmental funding	Main orientation
Public	63	3,528	56.0	99.9%	Agriculture
Governmen-tally supported	28	8,559	305.7	93.3%	Engineering
Others	78	2,308	29.6	70.7%	Engineering
Total	169	14,395	85.2	92.3%	Engineering (60% of research manpower)

- Predominant governmental funding
- Good fit with needs of industrial sector (engineering)
- Significant capabilities accumulated since the 70s/80s
- Increased flexibility since the 1990s

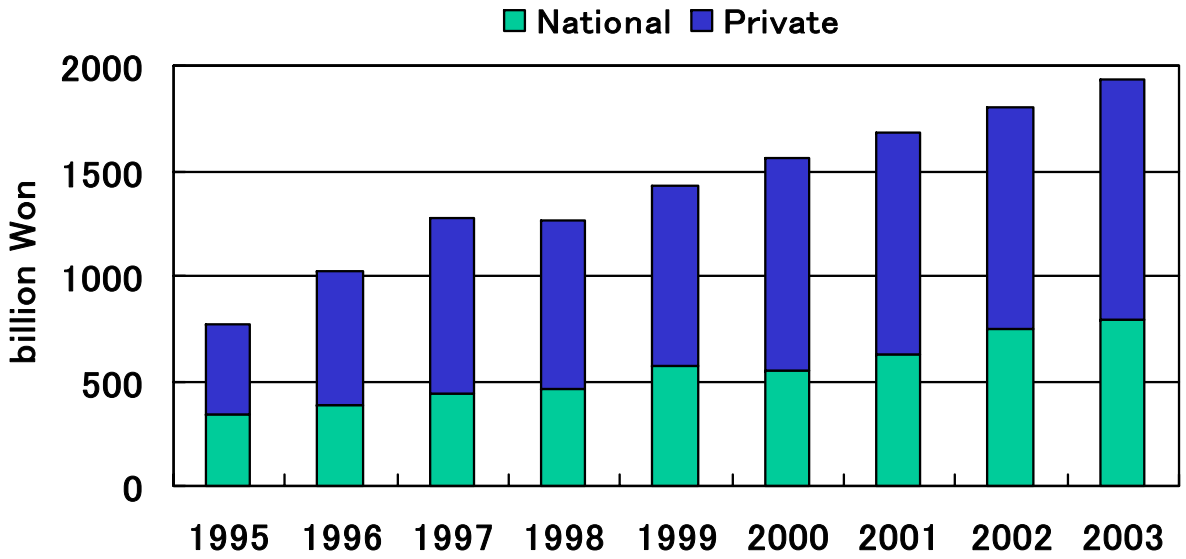
The Parts of the KIS: Universities and Higher Education System

Features of the Koran Higher Education System:

- **Extremely strong emphasis on education in general**
- **Worldwide highest formal education level of the younger age groups**
- **Education system strongly criticized for being outdated**
- **"Brain drain" of high school and college students**
- **Higher secondary and university education undergoing major reform**
  - **better fit with practical needs**
  - **internationalization**

The Parts of the KIS: Universities and Higher Education System

R&D spending of universities low…



…but rapidly expanding!

- Much higher priority given to research
- Networks with firms gradually developing
- Still more investment needed to upgrade R&D infrastructure

The Parts of the KIS: Inter-organizational Linkages

The Financial Market:

- **Indirect financing** (banks) traditionally predominant
- Mainly oriented towards large firms, low efficiency
- Financial market **reform** after 1997
- Government support programs for **venture capital**
  - ⇨ rapid expansion of venture capital sector
  - ⇨ overheating, need for improved screening standards

The Labor Market:

- Strong **dualism** between large firms (stable employment, high wages) and SMEs (hire and fire, low wages) until 1997
- Increased **flexibility** in the skilled labor market after 1997
- Increased **entrepreneurial activity** as a result of restructuring and harsh employment conditions in the corporate sector

The Parts of the KIS: Inter-organizational Linkages

Inter-organizational and inter-sectoral knowledge flows:

- **Poorly developed** inter-organizational linkages pre-1997 (exception: firm networks within chaebols)
- Recently **gradual improvement** due to structural changes in factor markets
- Development of **university-industry linkages**, fostered by governmental support
- Still widespread **stand-alone mentality** among managers and firms

Conclusions and Implications

The Korean Innovation System: Overall Evaluation

Strengths:

- strong competitiveness in some high-tech industries
- rapid expansion and skill formation
- comprehensive structural adjustment
- strengthening science base

Weaknesses:

- still heavy concentration of resources on large chaebol firms
- SME/venture sector needs further development
- open network culture / inter-organizational links only gradually evolving

Conclusions and Implications

The Korean Innovation System: Future Perspectives

- rapid development and adjustment as a **dynamic source of competitive strength**
- still some way to go to become a leading country not only in **technology**, but also in **science**
- **continued competitive pressure** from following catch-up countries (China, South-East Asia, India)

⇨ Considerable potential for technological leadership in some areas on the base of mutual interdependence

Conclusions and Implications

Implications from an international viewpoint

- Korean firms to be taken seriously as **innovating competitors** (and sometimes technological leaders)
- Strengthening science base and ongoing internationalization make Korean organizations **attractive partners** for international collaboration in science & technology