GLOBAL EDUCATION DIALOGUES

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Japan's Triple Helix Experiences: Lessons Learnt for ASEAN

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Presentation Outline

1. Japan's technological development and industrial catch-up

2. Triple Helix during catch-up period

3. Triple Helix during *post* catch-up period

4. Lessons learnt

5. ASEAN's challenges

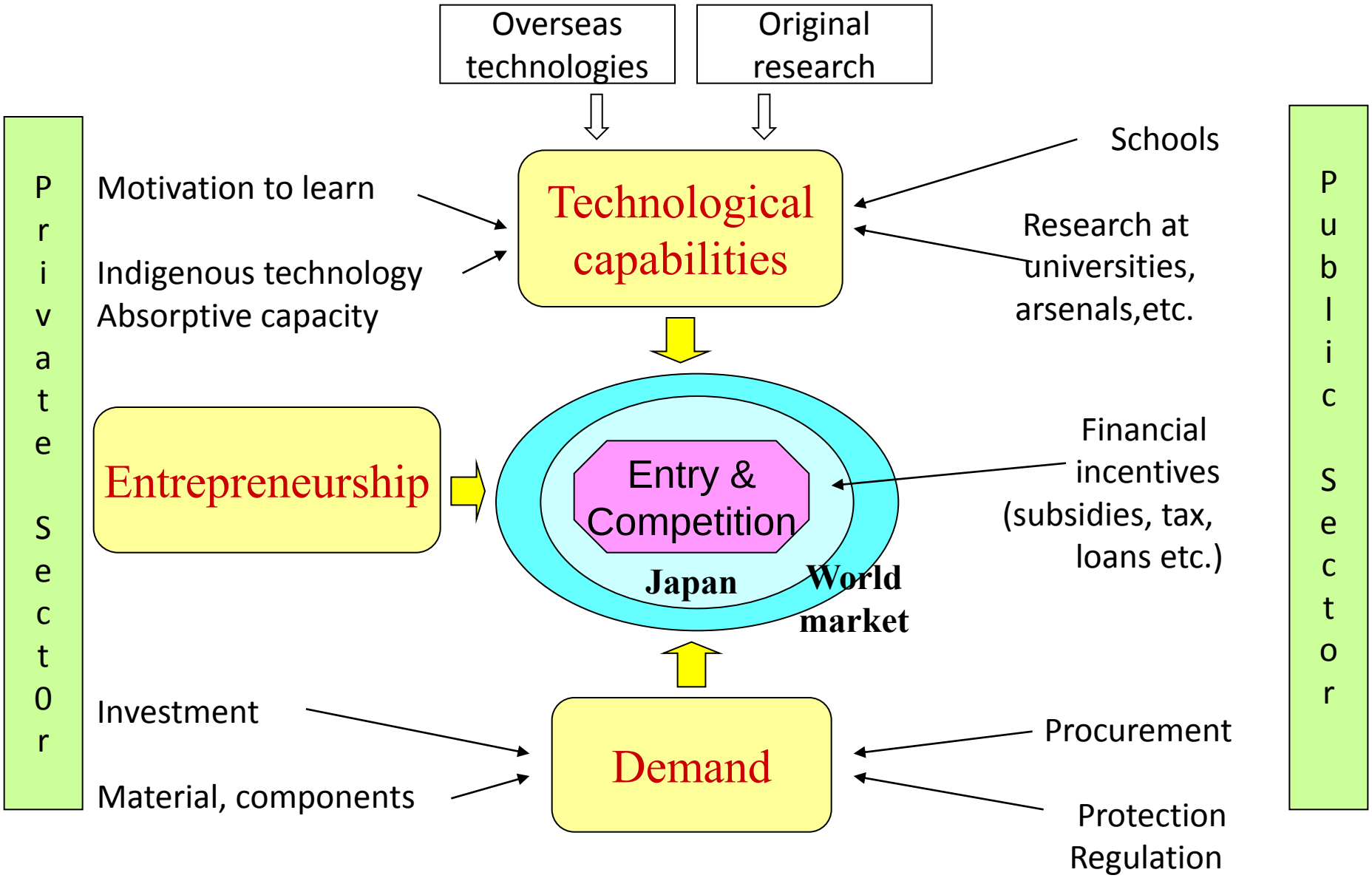


Fig. Technology and industrial development in Japan: the basic view

by Odagiri & Goto

The post catch-up period since 1990s

- Japan became net technology exporter in early 1990s. Reached technology frontier.
- The two lost decades (1990s-2000s)
- Increasing emphasis on *science-based* innovation (vs. engineering based in the catch-up period)
- Promotion of university patenting and university-industry collaborations
- Stronger enforcement of IPR

Triple Helix during catch-up period

Key features

- Long standing U-I linkages based on informal and individual basis
- Department of engineering, Tokyo University set up in 1873 educating very practical engineers (*2 years of practice* out of total 6 years).
- A national PRI, RIKEN started in 1917 providing technologies to 63 local firms in RIKEN Industrial Group through contracted research, licensing and production work (pilot plants)
- Public research institutes were set up across Japan by central and local governments to help local firms build up *indigenous* capabilities.

Local Industrial Public Research Institutes

As of June 1912

•Fukushima Prefecture	textiles and spinning
•Fukui Prefecture	textiles
•Ehime Prefecture	dyeing and weaving
•Kyoto City	pottery and porcelain
•Osaka Prefecture	testing industrial materials and products, and other testing and analyses
•Kyoto Prefecture	dyeing and weaving
•Yamanashi Prefecture	dyeing and weaving
•Shizuoka Prefecture	lacquer ware, paper and Dyeing and weaving
•Hiroshima Prefecture	dyeing and weaving
•Gifu Prefecture	dyeing and weaving
•Mie Prefecture	dyeing and weaving, and other manufacturing
•Kagawa Prefecture	soy source
•Shiga Prefecture	dyeing and weaving

Source: M. Kondo, Yokohama National University

R&D Consortium as Triple Helix Mechanism

- Early catch-up:
  - consortium in traditional industries (textile/ceramic) formed by trade associations with assistance of local PRIs
  - Consortium *linking users and suppliers* (e.g. between steel and shipbuilding firms) leading to innovations in both sectors
- Later catch-up:
  - *Joint ventures* formed by MITI and large existing firms to invest in high-tech startups
  - *Research associations* formed by large firms to solve specific longer-range, risky problems necessary for catching up. Some partially subsidized by government. Member firms received special tax breaks. Head of research sometimes on loan from PRIs.

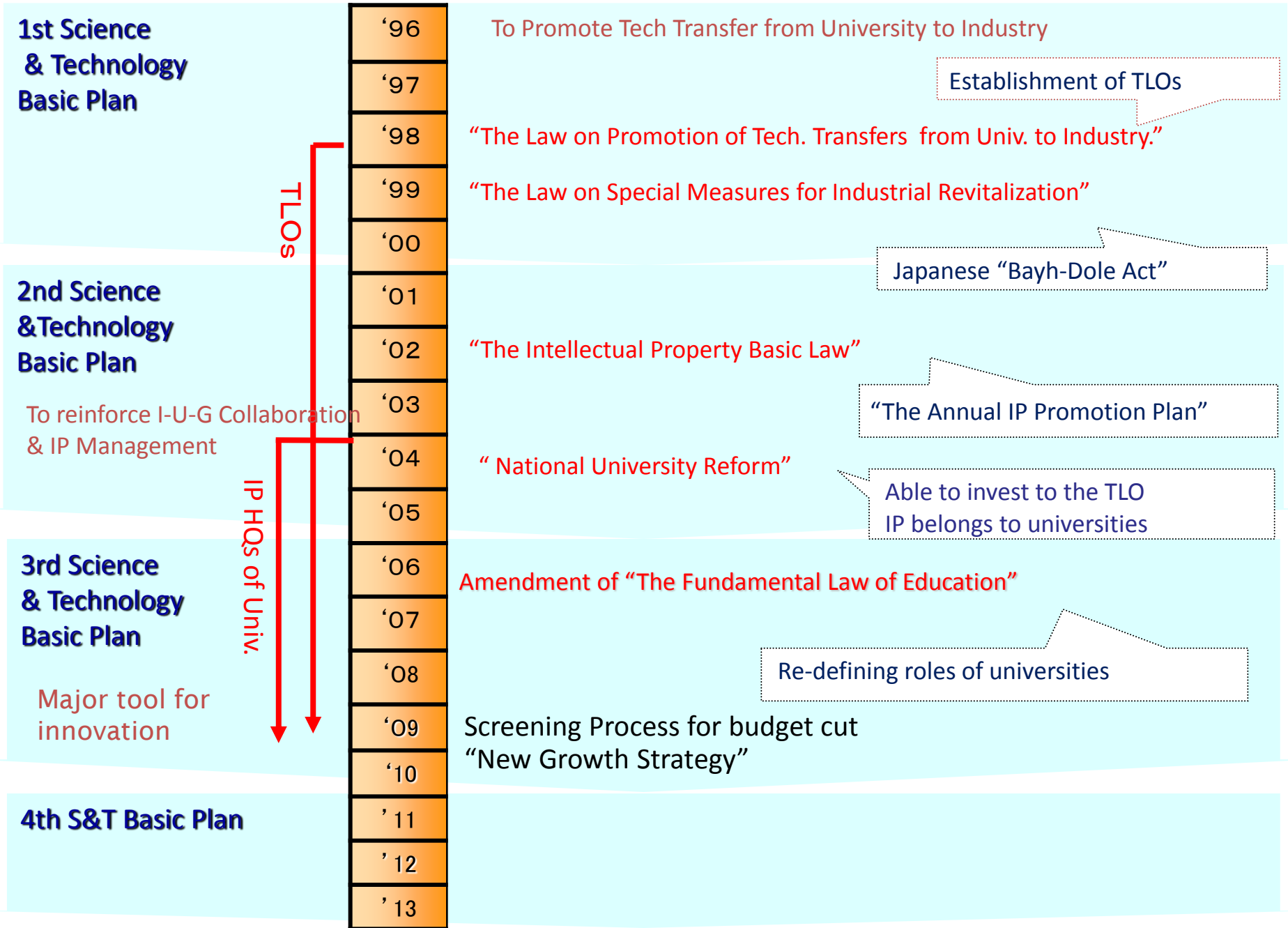
  Successful cases: VLSI and optoelectronics

Triple Helix during the *post* catch-up period

Key features

- several laws/policy initiatives were introduced to encourage better interaction between universities/PRIs and industry
- Third mission of universities emphasized: knowledge from universities would lead to innovation, new startups, and creation of new path-breaking industries. Get Japan out of lost decades.
- Many followed the US model
- More formal and patented-based UILs via intermediaries like TLOs,TTOs, incubators
- Mixed results

Chronological table of University-Industry Collaboration Initiatives



Overview of Promoting Policies for Industry Collaboration & Regional Innovation

MEXT Policy **JST Policy**

JST stands for Japan science and Technology Agency
which is one of the independent administrative institutions in Japan.

【Project for Developing Innovation Systems】

Regional Innovation Strategy Support Program

Effectively support a high-quality locally led scheme to encourage regional innovation.
In particular, new support for research conducted by multiple regions.

①Support to Forming Regional Cluster under Local Initiatives

③【Infrastructure of industry-university cooperation】

・University Research Administrator (URA)

⑤【Support for patent applications】

・JST support center for technology transfer
・JST support for overseas patent applications

Outputs / Outcomes of basic research

【Creating an environment conducive to beefing up support for commercialization】

②Project for Creating New Industries from Universities

Set up a system to encourage innovation by creating a team at universities and similar institutions to work on commercialization beginning at the invention phase and by promoting unified R&D and business development.

Support for collaborative research (ideas-push)

・**④ A-STEP** Adaptable and Seamless Technology Transfer Program through Target-Driven R&D

Support for top-down collaborative projects

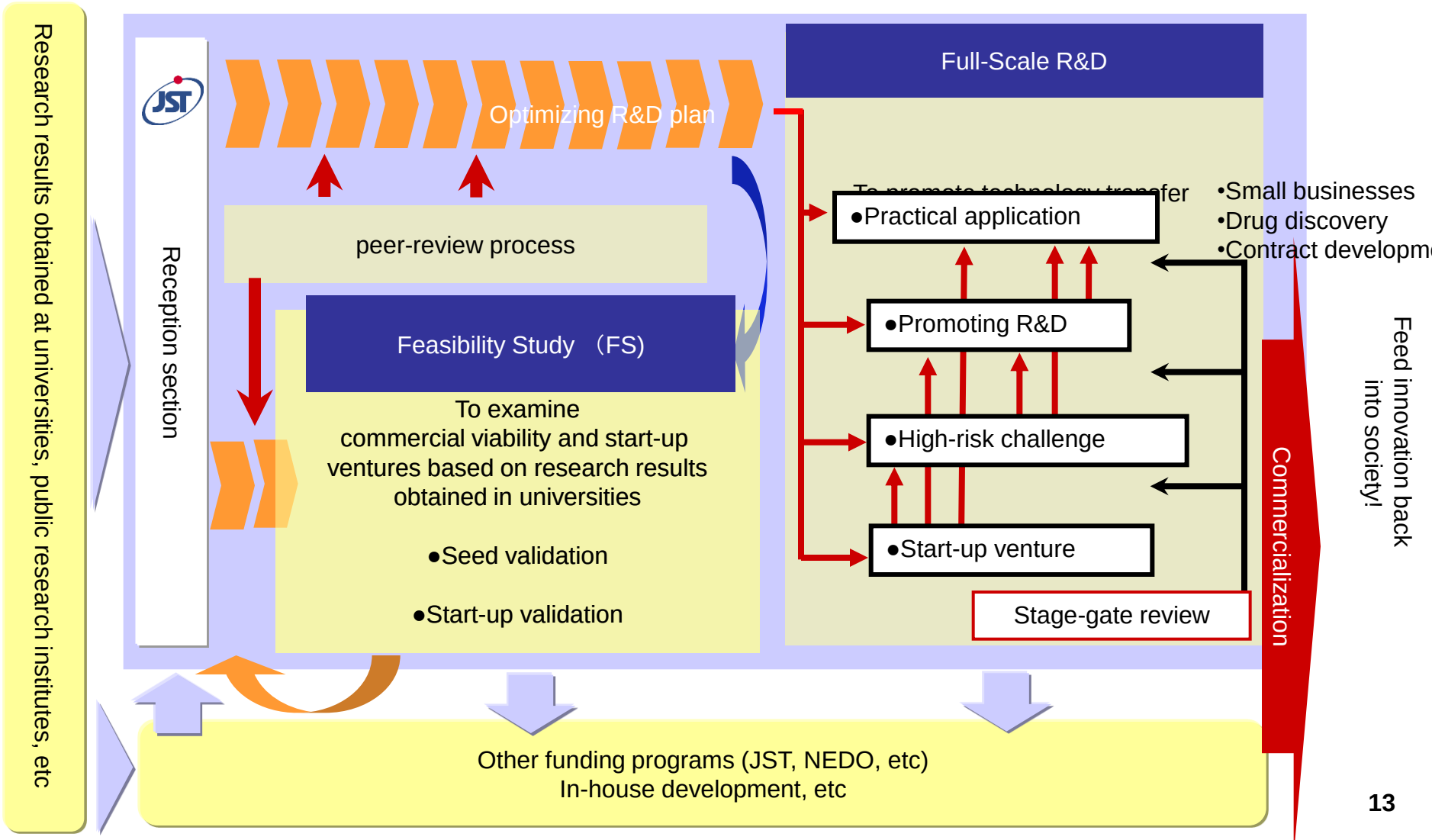
1.Large-scale and long-term R&D projects with consortiums

2.Development of systems and technology for advanced measurement and analysis

3. Cooperative basic research projects to solve problems in industry

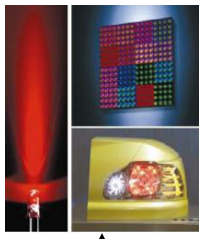
FY2013 Budget: 14.5 billion yen

- Covering all fields of R&D for technology transfer including medical sciences.
- Application is submitted jointly by university researchers and company partners.

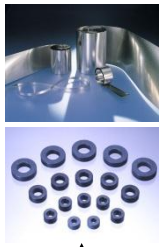


Pioneering Results brought by A-STEP and Previous Projects

1972
High luminosity Red LED
➔ Display device



1977
Amorphous metals
➔ Magnetic components in electronic devices



1986
GaN-based blue LED
➔ Display devices

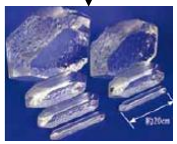
1997
Polymers with phospholipid polar group
➔ Cosmetics, contact lenses, biocompatible materials

2000
^{18}O-labeled water for PET diagnosis
➔ Early detection and treatment of cancer

2003
Retinoic acid nanoparticles
➔ Cosmetics

2004
Large high-precision scanner system
➔ For cultural assets etc.

Since1958



1959
Synthetic crystal
➔ Radios, TVs, Watches, mobile phones, PCs

1980
Interferon preparation (IFN_β)
➔ Medicine for Brain tumors, malignant melanomas, viral hepatitis B

1990
Oxide superconductor
➔ Superconductive cables/motors

1991, 1998
Optically active alcohols
✪ Practical application of research by R. Noyori (Nobel Prize in Chemistry 2001)

2000
Mitigating method for heat island phenomenon
➔ Water-retentive pavement

2005, 2006
Production engineering of valuable antibodies
➔ Surgical influenza face masks, air cleaner

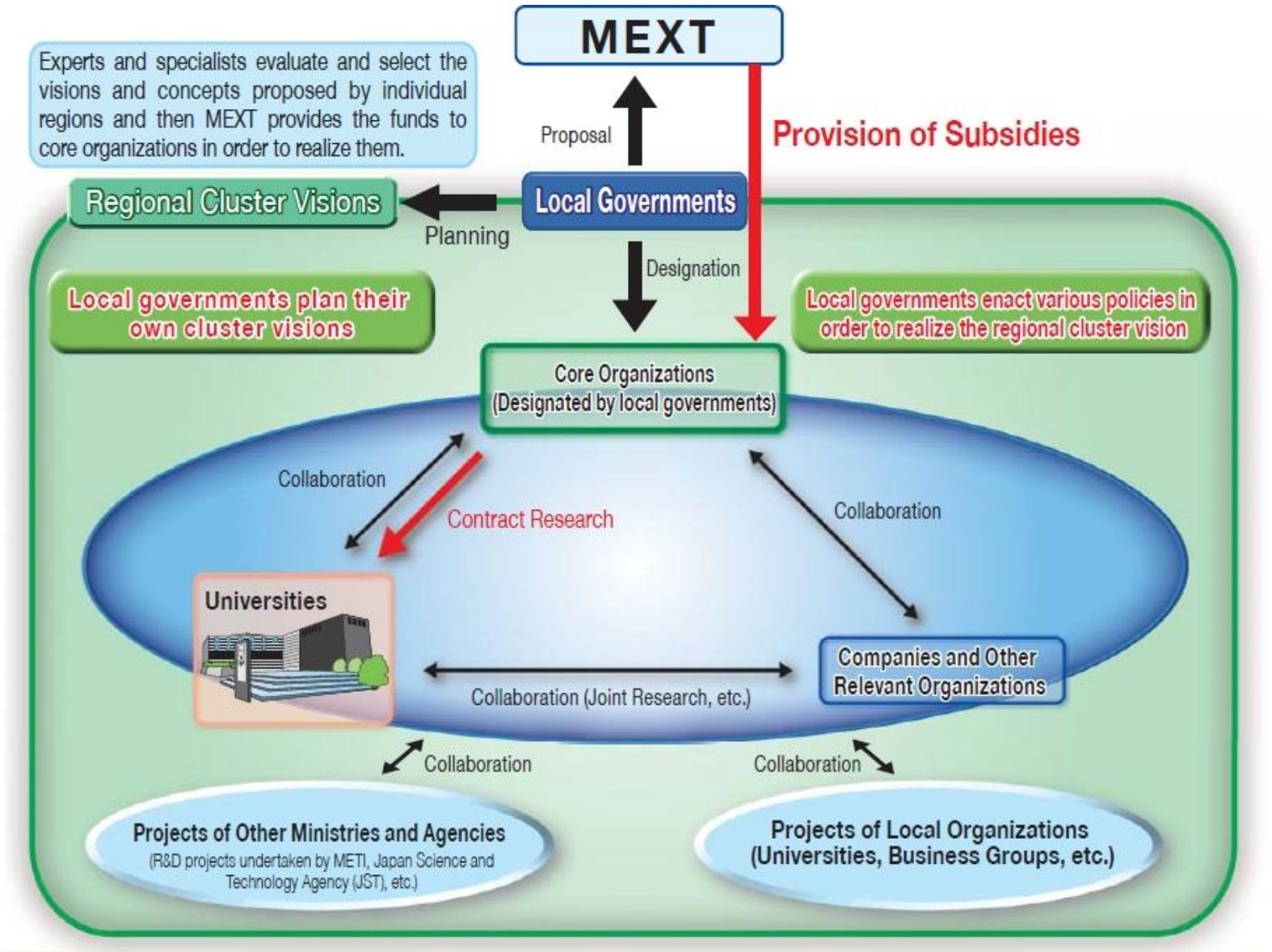
JST-launched start-ups : 248 (as of Nov. 09; cumulative)

- 12% of all academic start-ups ever established.
- Gross sales: ¥11 B, Employees: 1,800
- Benefit for the overall economy: ¥20 B

Licensing income: ¥19 B (as of Jan. 2010, cumulative)

- Benefit for the overall economy: ¥627 B (approx. estimation)

Structure of the Regional Innovation Cluster Program



Support to Forming Regional Cluster under Local Initiatives (2012)

Knowledge Cluster Initiative

MEXT strongly supports the formation of world-class clusters, while encouraging regional independence, in cooperation with relevant ministries such as METI

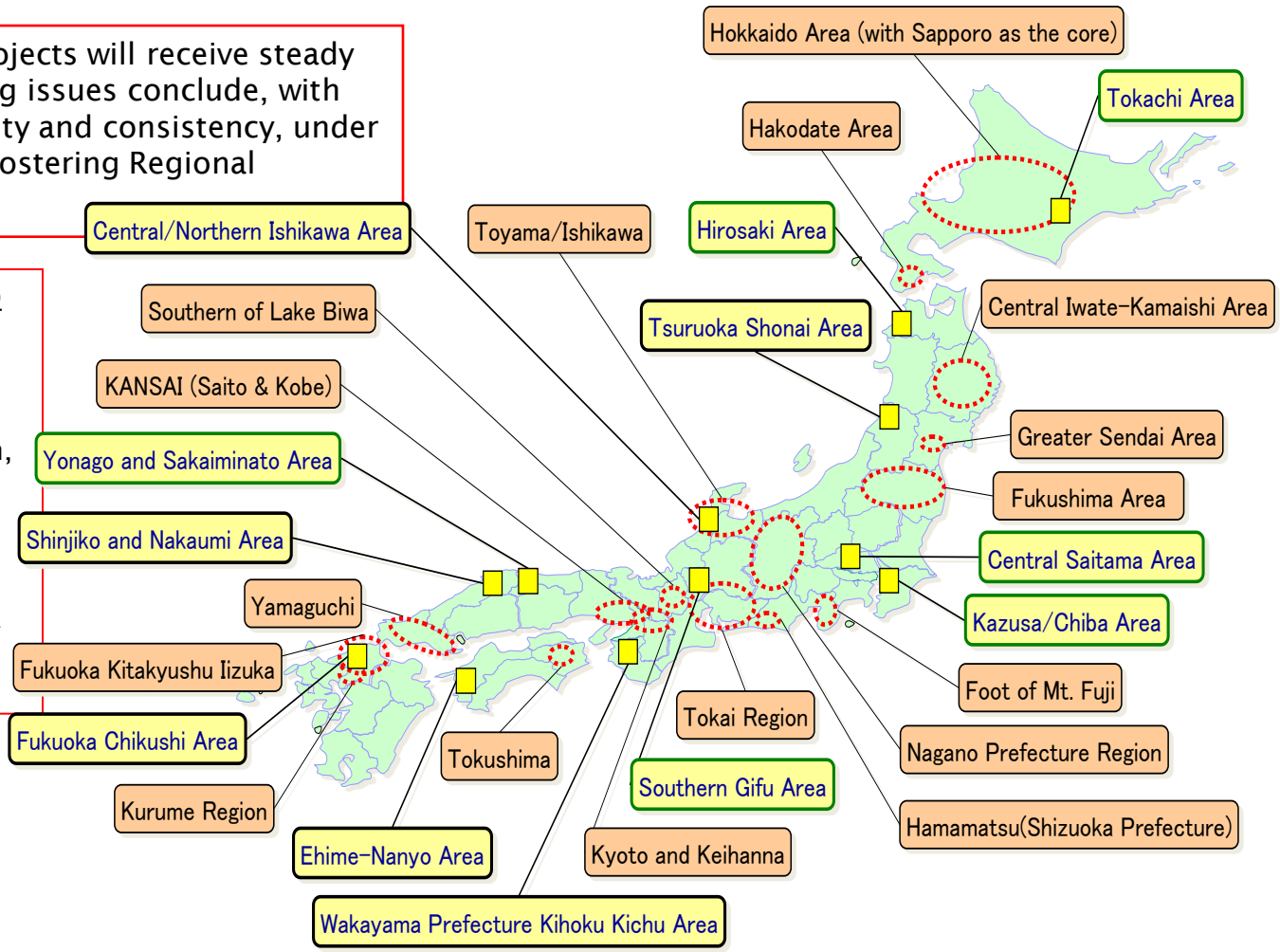
City Area Program

MEXT supports the creation of new businesses and R&D businesses that utilize unique regional resources through industry-academia-government collaborations

Knowledge Cluster Initiative and City Area Program Map

On Ongoing Regions

Regions with ongoing cluster projects will receive steady support until 2013 when ongoing issues conclude, with consideration to project continuity and consistency, under the banner of the "Program for Fostering Regional Innovation" for ongoing regions



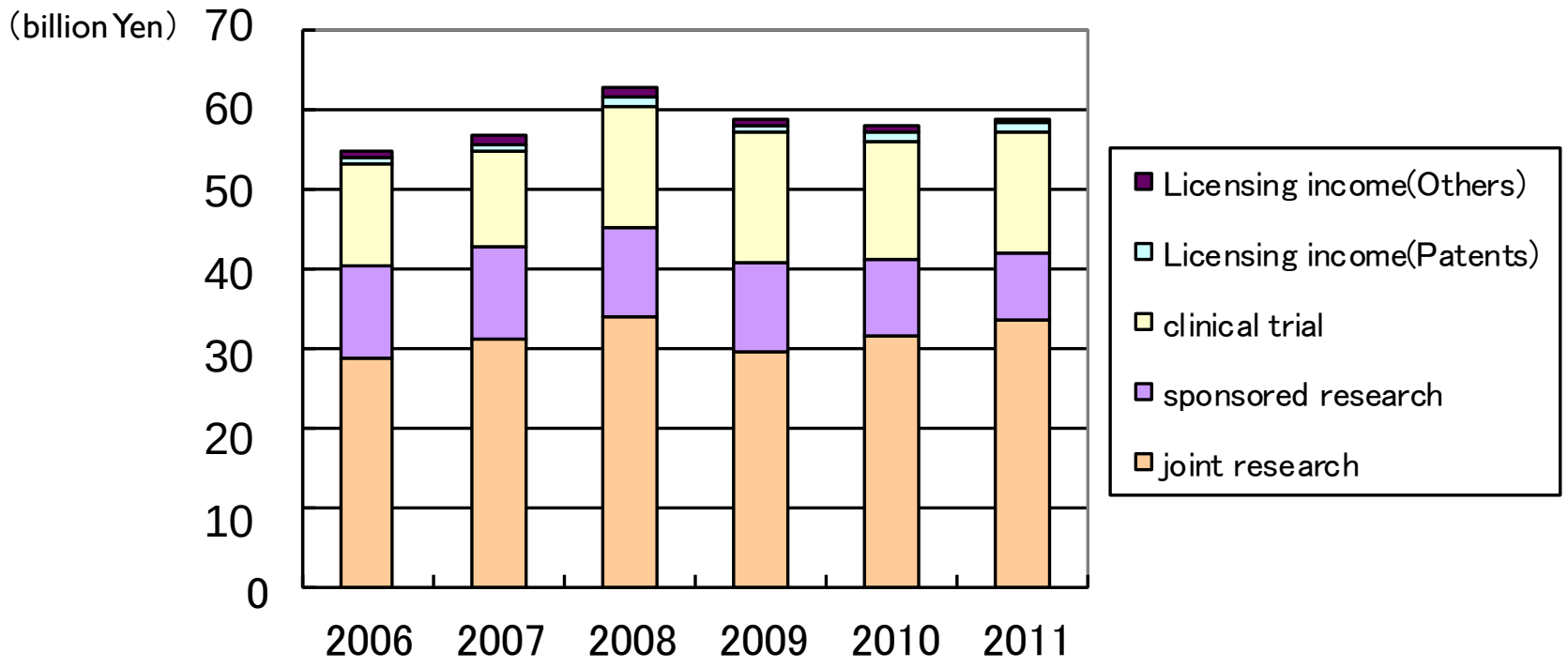
Typical Results (FY 2002 to 2010)

- ✓Patents Domestic 3,829
  International 692
- ✓Practical Use (commercialization, Incorporation, etc.) 3,434
- ✓Articles Domestic 4,655
  International 9,435
- ✓Sales of related products
  Approximately 82.2 billion JPY
  (7.53 billion EUR)

Trends in University-Industry Collaboration in Japan

- The amount of funds received from the private sector totally increases over 5 years from ¥54.9B (FY2006) to ¥ 59.0B (FY2011)
- However, licensing income remains at almost the same level.

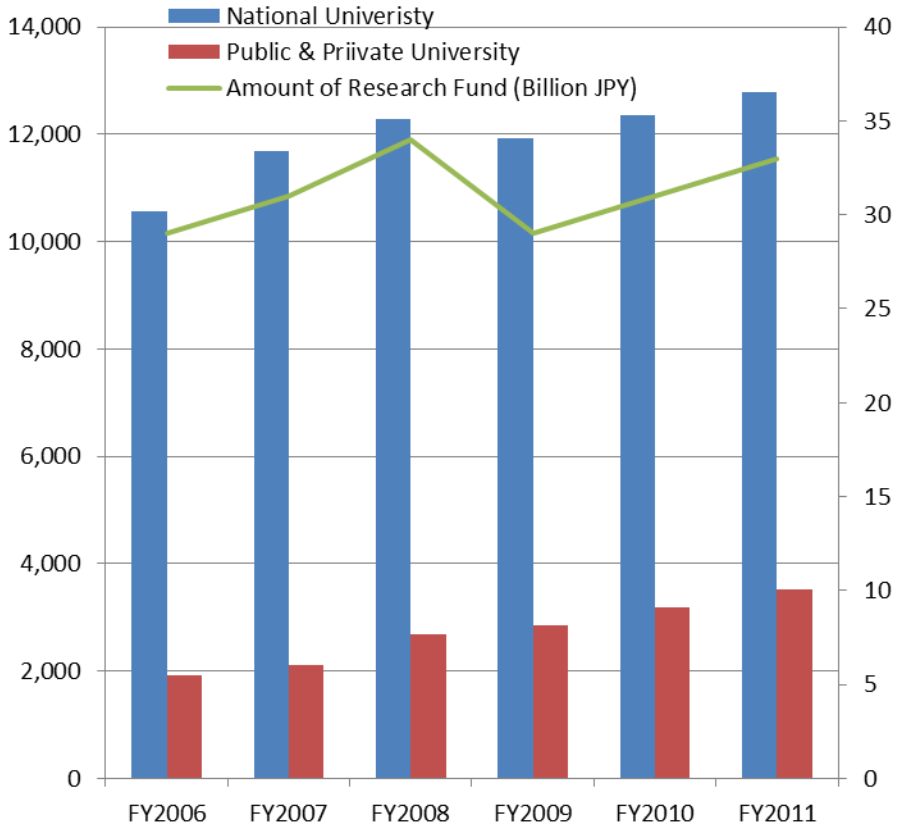
< Amount of funds received by Universities from the private sector >



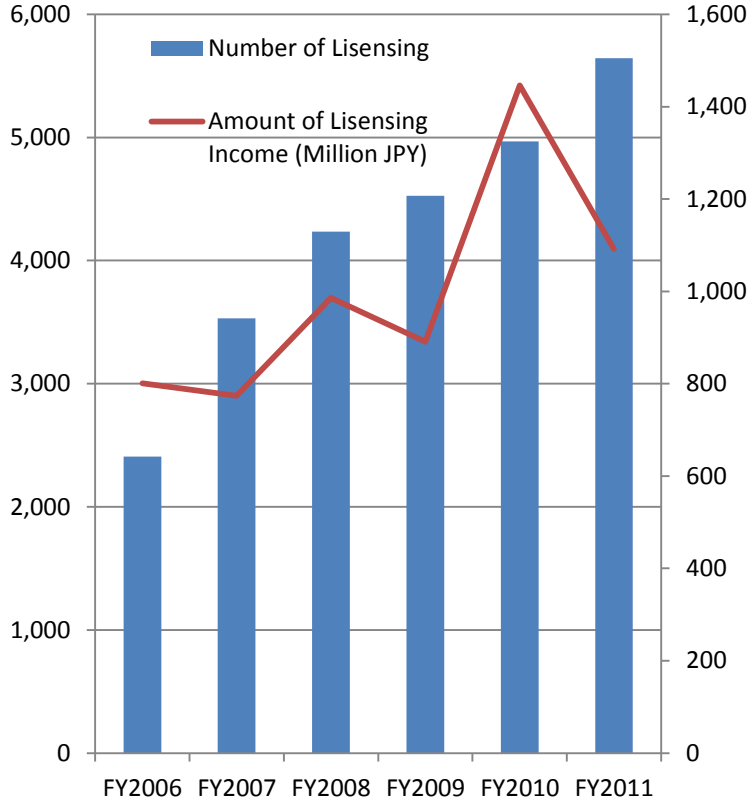
[Survey by MEXT]

Trends in University-Industry Collaboration (Cont'd)

Collaborative Research between University and Industry



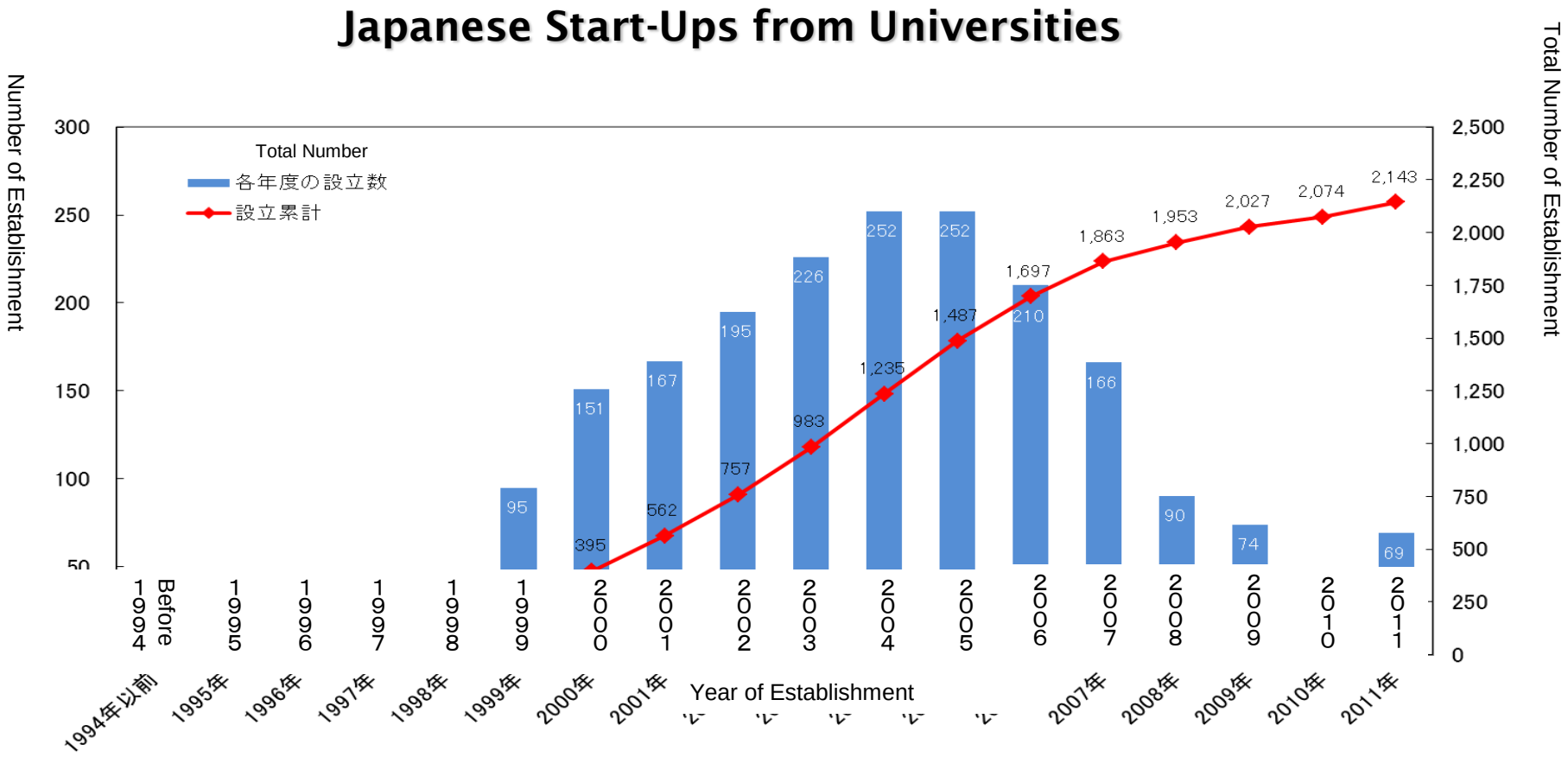
Licensing of University Patents



Trends in University-Industry Collaboration (Cont'd)

The number of start-ups from universities became over two thousands in 2009
However, the number of the establishment is gradually decreasing after 2004

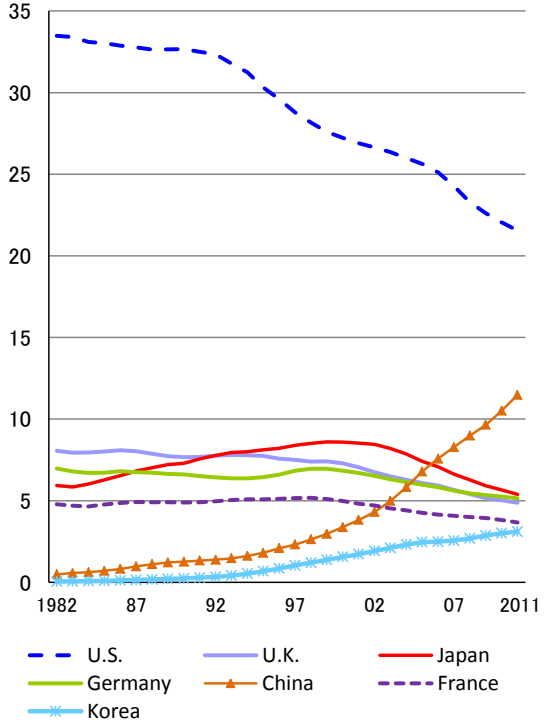
Cases



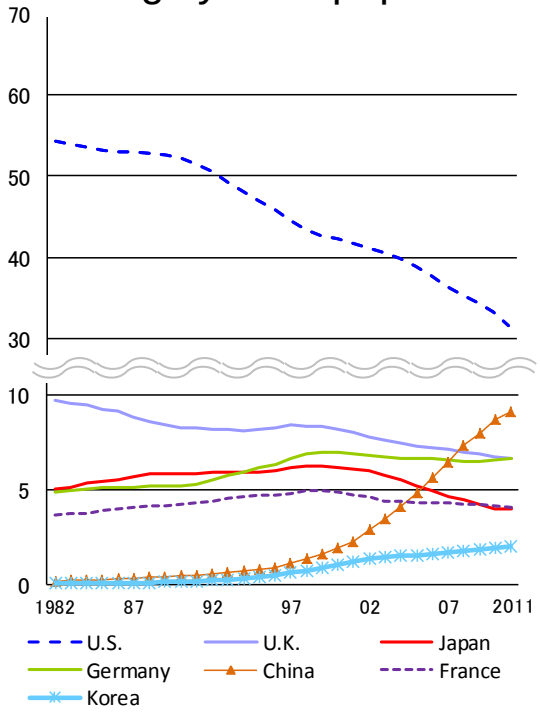
[Survey by MEXT]

The change in the share of the numbers of papers in main countries

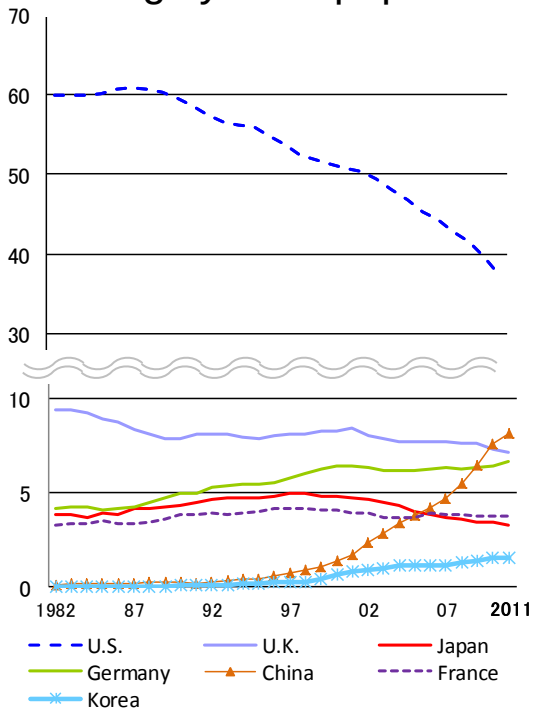
The Share of the number of All papers



The Share of the number of Top10% highly cited papers



The Share of the number of Top1% highly cited papers



Data: 3-years moving average of share tabulated from Thomson Reuters "Web of Science(SCIE, CPCI-S)" by fractional counting.

Source: National Institute of Science and Technology Policy, Japanese Science & Technology Indicators 2013, Research Material-225, August 2013

Lessons Learnt for Others, especially ASEAN

- Impressive mechanisms e.g. some practical engineering departments, roles of local PRIs, research consortium during catch-up period
- Post catch-up period: mixed results
- Pros:
  - Long-term continuous national policy
  - Integrative financial supports in every stage
  - Regional policies: cluster initiatives engaging local firms, universities, PRIs, venture capitals, etc.
  - Evaluation/monitoring process

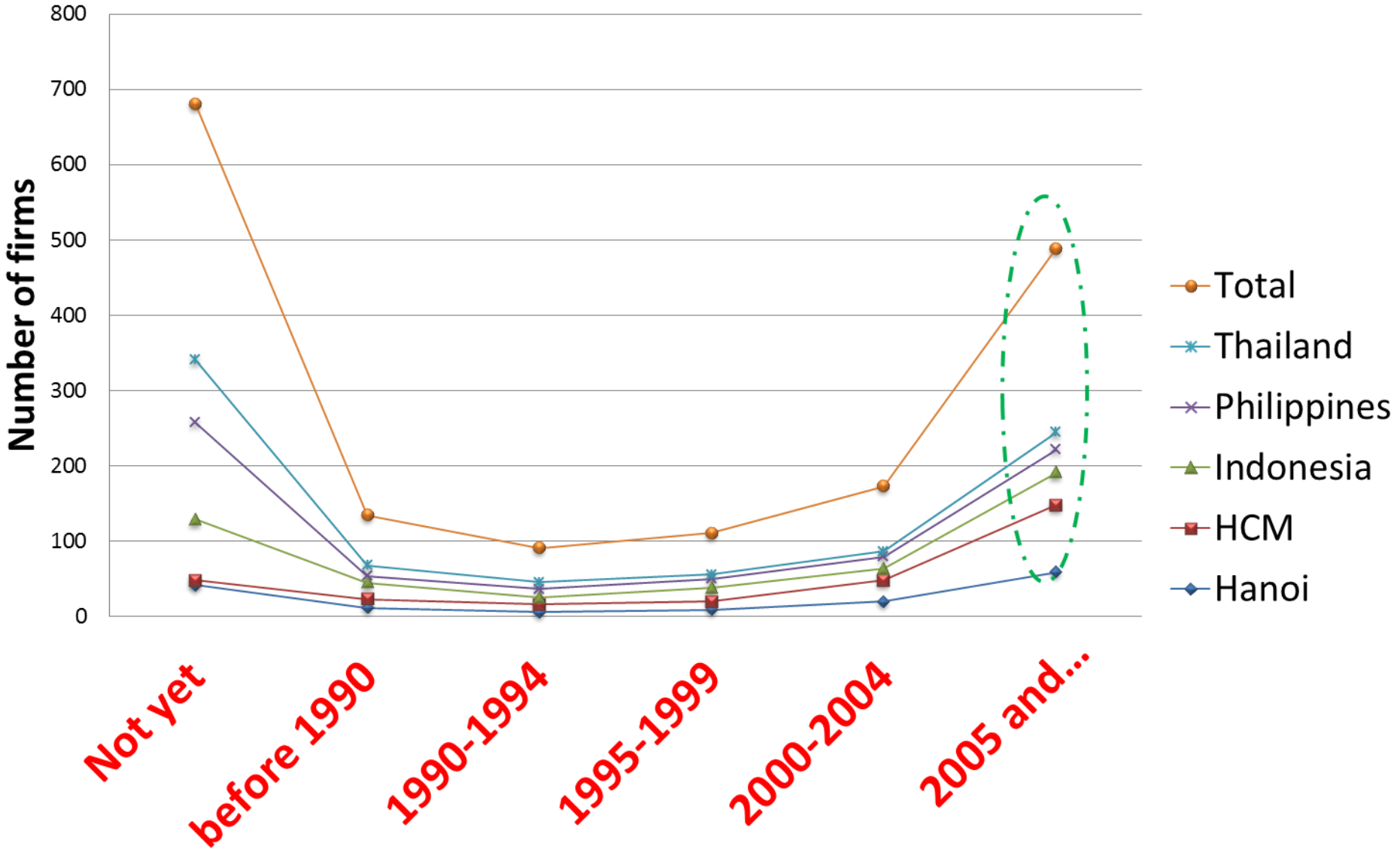
Lessons Learnt for Others, especially ASEAN (2)

- Cons:
  - Too much emphasis on entrepreneurial roles of universities?
    - Neglecting traditional strengths (spinning off from large firms, corporate ventures, intrapreneurship)
    - Not all universities have to be entrepreneurial (teaching/research universities)
  - Too much emphasize on patent-based technology transfer through TTOs/TLOs (vs. contracted research, *informal* interaction, HR mobility)

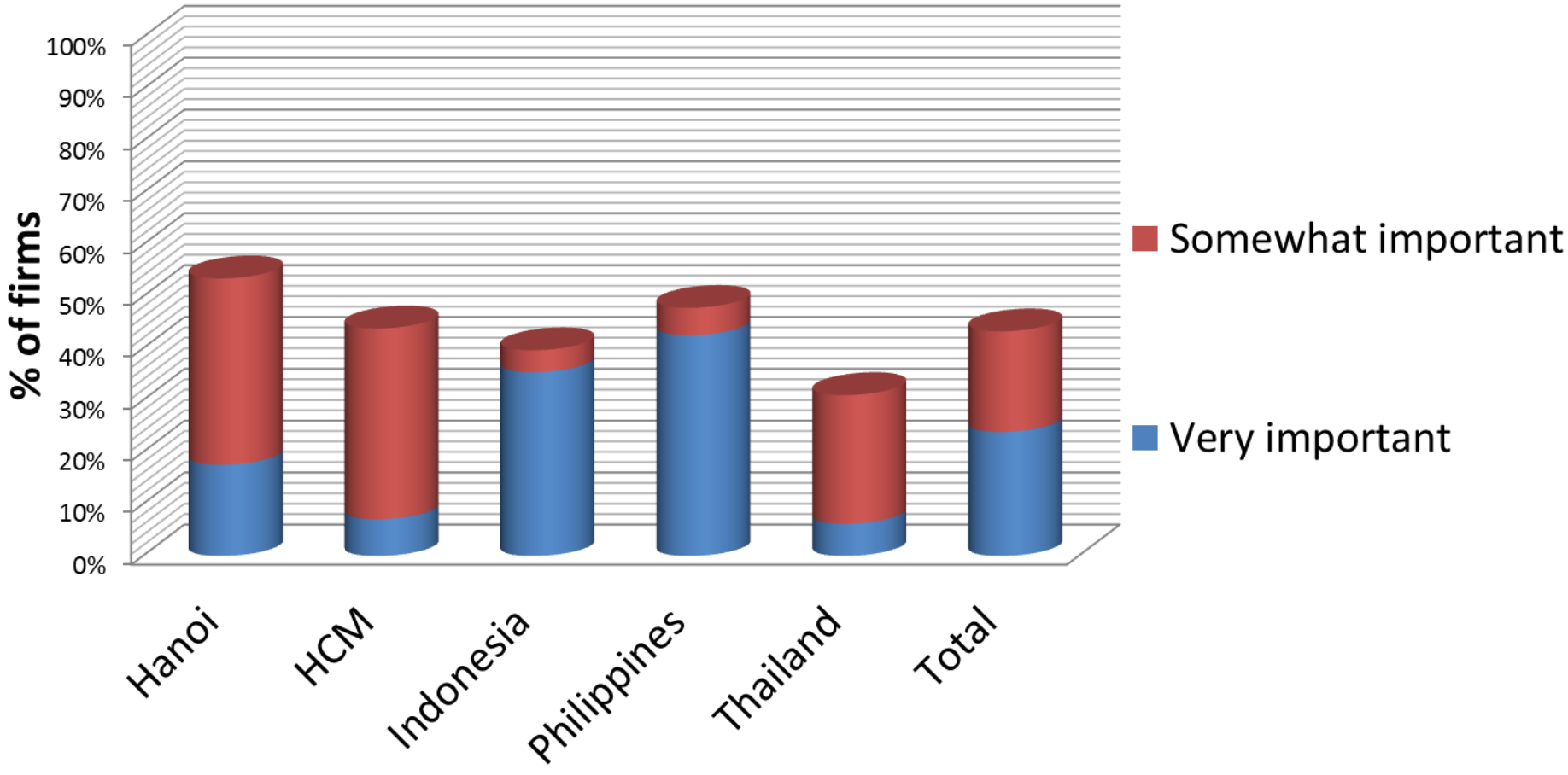
New Trends in ASEAN

- Increase in R&D Capabilities of Firms
- More roles of universities as sources of firms' innovation

Increasing Number of R&D performers



Universities or Public Research Institutes are Increasingly Important Sources of Innovation



ASEAN 5

- Well aware of importance of triple helix
- However too many ‘me-too’ policies (TLOs, science parks, incubators)
- Need local/regional RTOs to help firms enhance advanced *engineering, design and r&D* capabilities necessary for upgrading in global value chain.
- *Intermediary roles* of RTOs between
  - MNCs-local firms
  - Large local firms-SMEs
  - Universities-firms
- More roles and capabilities of *local government* and agencies. Less top-down initiatives.
- Better *division of labor* among universities (teaching vs. research vs. third mission)

CLMV

- Universities: focus more on first mission (teaching). To build critical mass of professionals/engineers
- RTOs: helping local firms to efficient production capabilities (like Japan before WWII). Intermediary roles

Thank you very much