

Policy Supporting Innovation and Technology Upgrading in Firms: East Asian Experiences

Patarapong Intarakumnerd

Professor

National Graduate Institute for Policy Studies (GRIPS), Japan

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Objective of Policies in the Context of Late-comer Countries

- Sequence of capability accumulation/deepening:

Engineering → Design → Development → Research

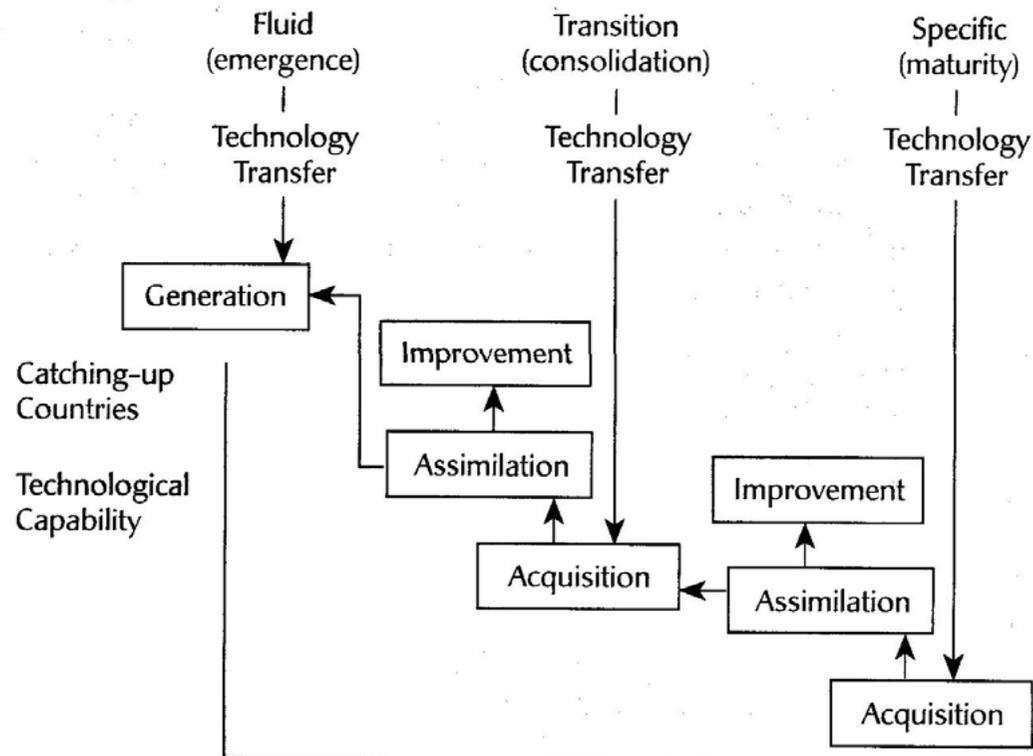
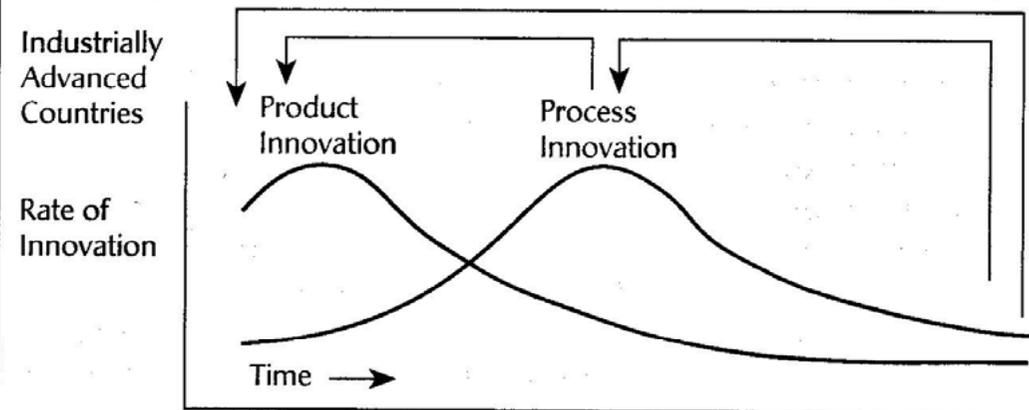
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Research → Development → Design → Engineering

- Absorptive capability for acquiring, adapting/improving imported technology is crucial.
- Two types of ‘learning’ of Latecomer firms:
 - Passive Learning by Doing: ‘doing’ before ‘learning’
 - Proactive Learning: ‘learning’ before ‘doing’
 - reverse engineering
 - R&D for building up absorptive capability
 - interactive learning: learning from others

Catching up Process of Latecomers: Reverse Learning

Figure 4-2 Integration of Two Technological Trajectories



Source: Linsu Kim, 1997,
 Imitation to Innovation: The Dynamics of
 Korea's Technological Learning, Harvard
 Business School Press, Boston

Priorities Setting

Horizontal Priorities

- In latecomer context: critical capabilities necessary for moving up to the next stage
 - Agglomeration of firms (esp. subcontracting networks)
 - Design and engineering
 - Product development
 - Full-blown innovation activities (including branding and global distribution networks, management of IP)
 - Creativity

Vertical Priorities: Taiwan Example

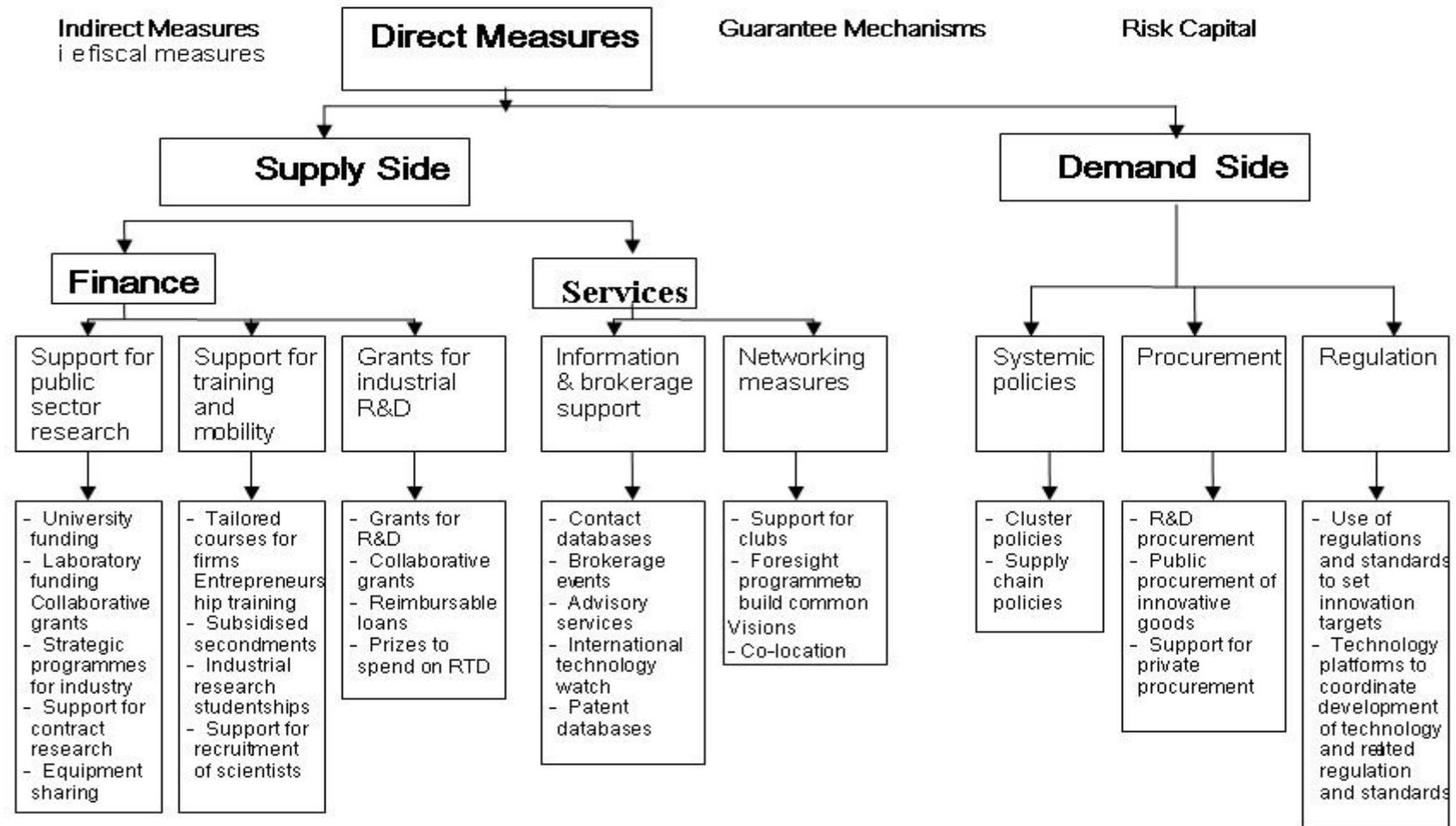
- Strategic **sectors**: selection criteria (1980s)
 - Two high: technology, value added
 - Two low: pollution and energy usage
 - Two large: market and (backward and forward) linkages
- Strategic (geographical) **clusters**
 - Hsinchu Science-based Industrial Park
- Strategic **products**: criteria (1990s)
 - Only those in strategic industries
 - Technologically superior to those locally produced now
- Critical **components**: criteria(1990s)
 - High value-added and development potential
 - Improve industrial structure
 - Enhance competitiveness of downstream industries
 - Can be produced by in large quantity
 - Technology cannot be acquired or promoted by private firms alone

Supply-side vs. Demand-side STI Policies

Supply-side vs. Demand-side Policies

- **Supply-side** policies aim at increasing firms' incentives and capabilities to invest in innovation by reducing costs.
- **Demand-side** policies aim to induce innovation and/or speed up the diffusion of innovation through
 - increasing the demand for innovation,
 - define new functional requirement for products and services
 - improve user involvement in innovation production

Innovation policy instruments



Framework conditions: Science base - Contract research - Human resources - IPR - State Aid Regulations

Source: Georghiou 2007

Demand-side policy instruments

1. Public Demand

- General procurement
- Strategic procurement (technology-specific)
- Co-operative procurement

2. Regulation

- Regulation of product performance and product information
- Usage norms
- Support for standardisation and innovation-friendly self-regulation

3. Financial Support for private demand

- Demand subsidies
- Tax incentives

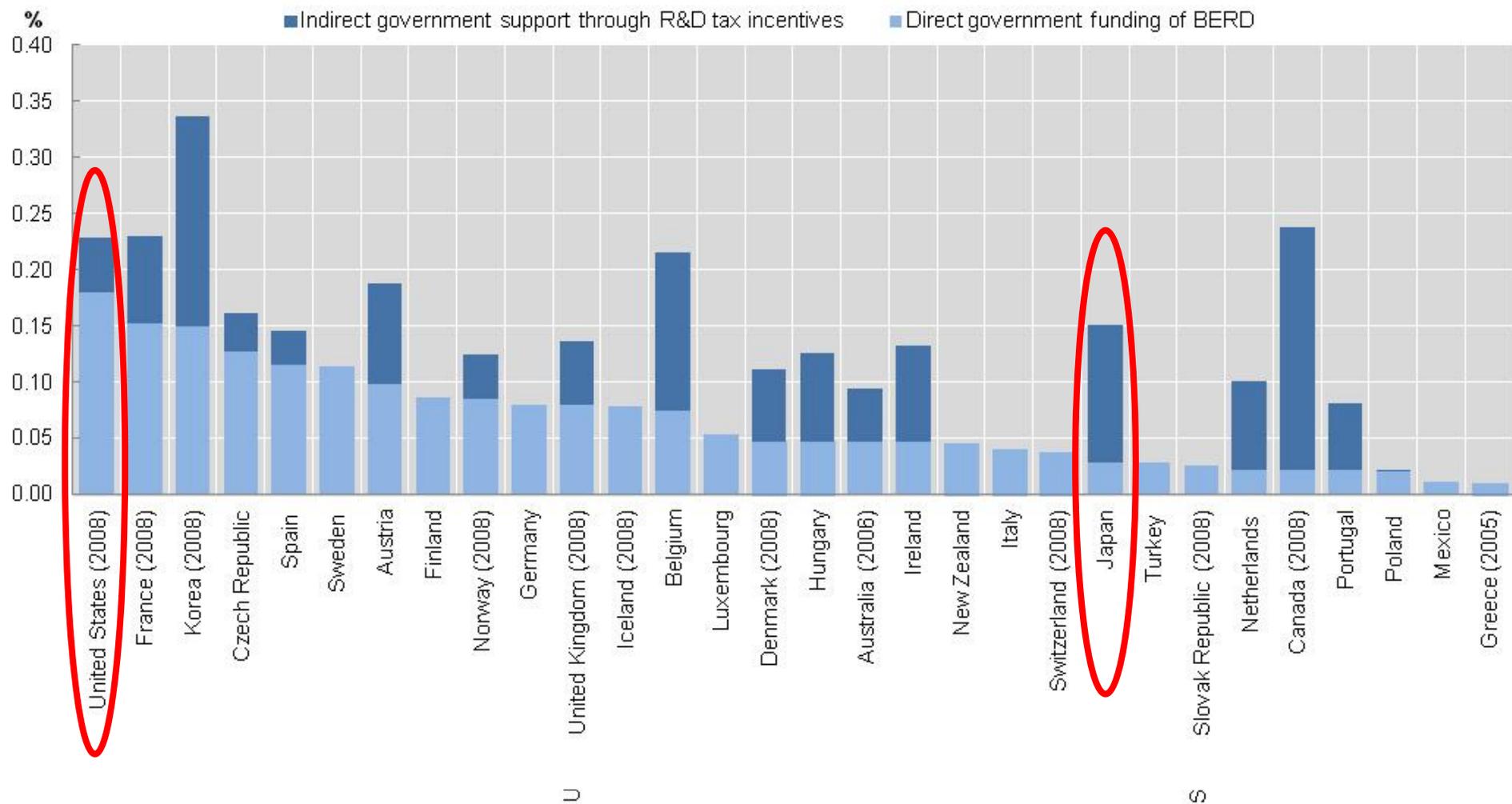
4. Non-financial support for private demand

- Awareness building, demonstration projects
- Voluntary labels or information campaigns
- Training & further education
- Demand articulation

Source: adopted from Edler 2013)

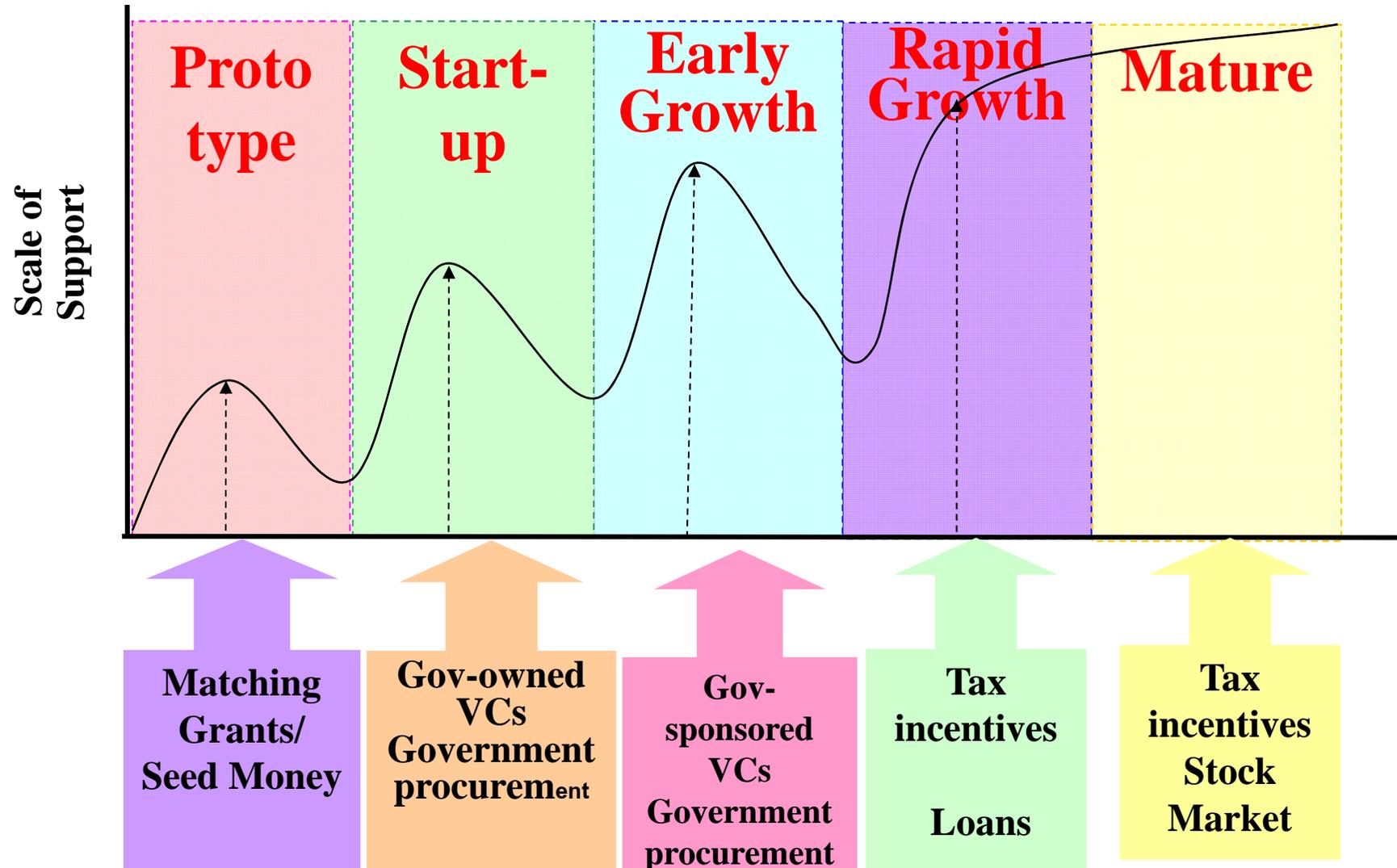
Direct and indirect incentives for business R&D

As percentage of GDP



<i>Measure</i>	<i>Benefits</i>	<i>Possible constraints</i>
Tax concession	<p>Non-discriminatory: open to all</p> <p>‘Arm’s length’ instrument: activities chosen by industry.</p> <p>Maintenance of firm confidentiality.</p> <p>Speedy processing (where approval ‘automatic’).</p>	<p>Of no benefit to unprofitable/start-up firms.</p> <p>Subsidizes ‘existing’ activity that would have occurred anyway (unless based on incremental performance, which is hard to police).</p>
Repayable loans	<p>Can be targeted widely or for focused activities.</p> <p>Priorities or scope (type, timing, size) set by govt., specific proposals made by firms.</p>	<p>Requirements against SMEs/startups (e.g. collateral)</p> <p>cumbersome & lengthy procedure.</p>
Grants	<p>For focused activities, sectors, clusters, type of firms. Prioritization allowed; appropriate for innovative projects. No need to write off.</p>	<p>Criticism on fairness</p> <p>Government ability to ‘select’</p>
Equity participation	<p>For focused activities</p> <p>Firms get investment money upfront: reducing risks & uncertainty and increasing creditability</p>	<p>Criticism on fairness</p> <p>Government ability to ‘select’</p> <p>Have to write off ‘bad’ project</p>

Life Cycle of New-technology-based Firms and Government Supports



Seed Money: Singapore

Start-up	Early Growth
<p>SEEDS</p> <ul style="list-style-type: none">- match dollar for every dollar an investor puts in business- at least \$75,000 up to \$300,000- SEEDS Capital* will take equity stakes	<p>Growth Financing Programme (GFP)</p> <ul style="list-style-type: none">- match a dollar for every two dollars an investor puts in business- up to \$1 million- both SEEDS Capital* and the third-party investor(s) will take equity stakes
<p>Business Angels Scheme (BAS)</p> <ul style="list-style-type: none">- invest with a matching dollar from SEEDS Capital- up to a maximum of \$1 million- Both SEEDS Capital* and the third-party investor(s) will take equity stakes	
<p>Entrepreneurial Talent Development Fund (ETDF)</p> <ul style="list-style-type: none">- provide a grant to start business for students and fresh graduates from 9 Institutes of Higher Learning (IHLs)	

Innovation Financing: Experiences of Taiwan, Singapore, Malaysia, Thailand

Lessons Learnt

- Different levels of technological and innovative capabilities of firms do need different policies instruments.
 - **Co-evolution** (Singapore/Taiwan) vs. static and **me-too** strategies (Thailand)
- more successful countries have a higher level of flexibility and policy coordination and learning.
 - **Selective** (technology, sector, cluster, product, type of firms) intervention allowed
 - tax incentives for startup companies can be converted to grants
- Long-term commitment required, as capability building take long time.

Lessons Learnt (2)

- Policy makers must understand what constitute innovations and innovation systems, and how they evolve overtime.
 - Difference for RHQ incentives between Singapore and Thailand
- Require other corresponding policy initiatives and institutions to implement policies effectively.
 - qualified human resources, attract foreign talent)
 - laws and regulations
 - unity and capability of government bureaucracy
 - trust
 - Entrepreneurship/entrepreneurial state (risk-taking government)
- Committed policies can change institutional shortcomings e.g. startup entrepreneurship in Singapore

Non-financial Instruments: Evolution of Roles of Public Research Institutes

Local Industrial Public Research Institutes in Japan in 1912

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

Source: M. Kondo, Yokohama National University

Period	Level of Technological Capabilities of Local Firms	Roles of ITRI	Supporting Instruments
1970s - early 1980s	basic operation capabilities Insufficient absorptive capacity.	Acquiring foreign technology through licensing in. Then carrying out R&D to understand, assimilate and adapt such technology. Then setting up new companies through spinning off	Spinning-off to create start-ups such as United Microelectronics Corporation (UMC) and Taiwan Semiconductor Manufacturing Company (TSMC), which later became world-class companies
1980s -early 1990s	Gaining design and engineering capabilities.	Acting as an intermediary to set up R&D consortium with local companies to produce prototypes which were subsequently developed further to be commercial products by each participating firms.	R&D consortium such as R&D consortia of notebook producers and R&D consortia of High Definition TV (HDTV) producers
late 1990s- present	R&D capabilities. Emerging of techno-preneurs interested in setting up new technology-based firms.	Strengthening R&D capability and R&D management of firms. Encouraging start-ups.	‘Open Lab’ allowing SMEs to use incubator to nurture start-ups

Examples of R&D alliances in Taiwan, 1983-1997

<i>Alliance</i>	<i>Year(s)</i>	<i>Companies</i>	<i>Budget</i>
		NT\$ m	
<i>A. Electronics and information technology</i>			
1. PC 100 (IBM PC XT-compatible)	1983-1984	5(9)	40
2. PC 400 (IBM PC AT-compatible)	1984-1985	3	24
3. Workstation (Sun SPARC-compatible)	1989-1991	2(3)	150
4. Notebook PC	1990-1991	46	100
5. Graphics terminal	1991-1993	34(9)	25
6. Palmtop PC	1991-1992	16	50
7. Pentium server	1991-1993	2	50
8. Taiwan NewPC (PowerPC)	1993-1997	40	250
<i>B. Consumer electronics and communications</i>			
1. Ethernet switch	1993-1996	5(8)	75
2. Digital loop carrier	1992-1994	3(4)	60
3. LCD consortium	1995-1997	4	230
4. HDTV	1994-1996	11	250
5. Interactive TV	1995-1997	21	200
6. V5 Network access standard	1996-	12	150
7. High speed loop access system	1996-	14	120
<i>C. Mechanical engineering/materials</i>			
1. 1.2 L engine	1992-1997	4(3)	1,400
2. Electric scooter	1991-1996	10	500
3. 250cc motorcycle engine	1996-	2	600
<i>D. Software/services</i>			
1. Java-based Internet products	1996-	24	250
2. Electronic commerce	1996-	61	300

Conclusion

- Priorities should be set in accordance with the needs for innovation and upgrading of firms.
- Demand side policies should not be neglected.
- Different financial policy instruments have pros and cons.
- Intermediary roles of government agencies are important.
- Need to build up institutions to implement policies effectively.

Thank You