Smart Specialization and industrial policy to avoid both target and design failures

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A Chapter by
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“Economic Catch-up as Evolutionary Process”

Definition) Catch-up = narrowing of a firm’s or country’s gap vis-à-vis a leading country or firm.

=> Catch-up = not only learning and building capabilities but also finding niches/entry points and sectoral specialization because we are ‘late entrants’ in the given international division of labor.

Two Related Issues
1) how to build up capabilities, 2) in which sector first (targeting); capabilities are sector-specific; sectors differ in learning and survival possibilities

=> Industrial Policy (IP) Issues
<table>
<thead>
<tr>
<th></th>
<th>Market failure (appropriation failure)</th>
<th>System failure (coordination failure)</th>
<th>Capability failure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Focus</strong></td>
<td>Market institutions</td>
<td>Interaction among actors</td>
<td>Actors (firms)</td>
</tr>
<tr>
<td><strong>Source</strong></td>
<td>Knowledge as public good</td>
<td>Cognition failure from tacitness of knowledge</td>
<td>historically given; No learning opportunity</td>
</tr>
<tr>
<td><strong>Example problem</strong></td>
<td>Sub-optimal R&amp;D</td>
<td>R&amp;D impact: low</td>
<td>No R&amp;D</td>
</tr>
<tr>
<td><strong>Solutions</strong></td>
<td>R&amp;D subsidies</td>
<td>Reducing cognitive distance</td>
<td>Access to knowledge and help in learning</td>
</tr>
<tr>
<td><strong>School Analogy</strong></td>
<td>Tuition support</td>
<td>Making more friends</td>
<td>Targeting student learning</td>
</tr>
<tr>
<td><strong>Relevance</strong></td>
<td>Developing and advanced countries</td>
<td>Developing and advanced countries</td>
<td>More unique to developing countries</td>
</tr>
</tbody>
</table>

From Keun Lee, a chapter in Stiglitz & Lin eds, 2013
Targeting vs. designing in Industrial Policy

Where and how to specialize?
A Talk relying on Keun Lee’s chapter in Slavo Radošević, et al 2017, on Smart Specialization
Smart specialization (Foray 2015)

• A Policy concept to reconcile two logics
  – **Vertical** (not horizontal) prioritization
  – **Bottom-up** Dynamism and entrepreneurship

Neither sectors nor individual but *new* activities

*Still, sector-non-neutral.*

• **Entrepreneurial discovery** & *new* activities

  - Policy design matters
  - Discovery process = discovering which innovative activities a region should specialize,
  - based on interactions bet. gov’t & private sector.
So, the Question is:

both **targeting** and designing?

With high uncertainty in supply (or high resource-constrained) and often weak entrepreneurial capabilities, we (esp. MICs) may need both.

Is targeting really difficult? esp when you are below frontier or gov’t driven discovery?
Example Situation 1: a coordinated discovery?

1) Korea in the early 1990s, faced the Three choices:
   a) keep making old analogue TV
   b) Follow Japan again to learn Analogue HD TV
   c) Leapfrog into Digital TV

=> Not necessarily market size uncertainty but more uncertainty with technological (supply-side) choices leading to different market competition
=> Not a matter of sectoral choice but how to manage the risk with leapfrogging by designing well
“Designing” Public-Private Joint R&D (not just subsidies but learning)
eg) Korean **Leapfrogging**: Digital TV, mobile phones (CDMA); China: 3G TD-SCDMA, Photovoltaic; electric vehicles

Policy tools: Standards policy matter,
eg), Gov’t imposed exclusive standards of CDMA standards in wireless.
Figure 1  Digital TV System and the firms assigned to develop various ASIC chips (Lee et al 2005, RP)

Source: KETI (2000: 353)
Notes: KETI is the Korea Electronics Technology Institute
Example Situation 2

Korea in the mid 1990s, on phones faced the 4 choices:

a) keep making old fixed line telephone
b) Follow US/Motorola to make analogue cell phones
c) Skip analogues but to follow Nokia to make digital (GSM) cell phones
d) Leapfrog into CDMA (Qualcomm) cell phones

=> market is there
(choice by firms not by gov’t; still uncertainty in tech choice)
=> Not a matter of sectoral choice but how to manage the risk with leapfrogging by designing well
Not a target failure but design failure

1) South Africa developed their own electric cars called ‘Joule’.
   • the South African government provided the initial funding and initiated the whole process of establishing in 2005 of a SOE called Optimal Energy.
   • Had an initial success by December 2010;

2) Given no firm for volume production, gov’t stopped further funding for large scale production; closed in 2012/06,

3) Why failure: lack of involvement of private companies who would take the role in volume production and sales.
   • Existing foreign MNCs and local auto companies did not want this new ‘disruptive innovation,’ SOE to grow as another rival.

4) Lesson: Should have formed a private-public consortium with the plan of volume production by the private actors.

=> A case of ‘design failure,’ not a ‘targeting failure.'
Targeting still matter for latecomer/MICs facing resource shortage & entry barriers

Hausmann and Rodrik (2006) :
"The idea that the government can disengage from specific policies and just focus on general framework conditions in a sector neutral way is an illusion ".

Then, consider
Smart Specialization with cycle time Technologies as a selection criterion
Other Criteria of Specialization

1) Diversification by product space (Hausman; Hidalgo)
   - but, which direction first among many low-hanging fruits (distance)?
   - hard to make a Long jump (from periphery to core)
   - also, tautology: you specialize what HICs do

2) high opportunity /high-V-added sectors
   -- but: how about competition/entry barriers

   target mature (left-over) sectors of country above you
   -- Makes sense; b/c to find a niche (lower entry barrier);
   but might need something more as get close to Frontier (leapfrogging)

4) Lee (2013): short cycle time: more theoretical criteria & also more for upper middle C’s
   => Viable Criterion: “entry/survival possibility with growth prospects”
Criterion = (short) cycle time of technologies: 
(Lee 2013 book)

Cycle time = speed of change in the knowledge base of a technology 
= mean citation lag (= how old patents you still cite)

“To catch up, specialize in short cycle technology-based sectors“
because old knowledge quickly obsolete/useless
  + new knowledge tend to emerge more often
  -> less disadvantageous for the latecomers (lower entry barrier)

  => technologies with greater growth opportunity
      from frequent emergence of new technologies

  ➔ You got to be different from the North, than trying to be similar from the beginning (opposite to Hausmann )
Short Cycle Technologies as a detour:

EA vs LA with different growth mechanisms

Mid 80s = 1st Turning point

High Income countries

Middle Income countries

Korea and Taiwan

Brazil and Argentina
### Top 10 Classes of European G5 vs Korea-Taiwan - no overlap

<table>
<thead>
<tr>
<th>G5</th>
<th>Class</th>
<th>Class Name</th>
<th>Patent count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>514</td>
<td>Drug, Bio-Affecting and Body Treating Compositions</td>
<td>10349</td>
</tr>
<tr>
<td>2</td>
<td>428</td>
<td>Stock Material or Miscellaneous Articles</td>
<td>3883</td>
</tr>
<tr>
<td>3</td>
<td>73</td>
<td>Measuring and Testing</td>
<td>3789</td>
</tr>
<tr>
<td>4</td>
<td>123</td>
<td>Internal-Combustion Engines</td>
<td>3479</td>
</tr>
<tr>
<td>5</td>
<td>424</td>
<td>Drug, Bio-Affecting and Body Treating Compositions</td>
<td>3389</td>
</tr>
<tr>
<td>6</td>
<td>210</td>
<td>Liquid Purification or Separation</td>
<td>2853</td>
</tr>
<tr>
<td>7</td>
<td>435</td>
<td>Chemistry: Molecular Biology and Microbiology</td>
<td>2852</td>
</tr>
<tr>
<td>8</td>
<td>250</td>
<td>Radiant Energy</td>
<td>2639</td>
</tr>
<tr>
<td>9</td>
<td>264</td>
<td>Plastic &amp; Nonmetallic Article Shaping or Treating</td>
<td>2349</td>
</tr>
<tr>
<td>10</td>
<td>324</td>
<td>Electricity: Measuring and Testing</td>
<td>2325</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Korea-Taiwan</th>
<th>Class</th>
<th>Class Name</th>
<th>Patent count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>438</td>
<td>Semiconductor Device Manufacturing: Process</td>
<td>1189</td>
</tr>
<tr>
<td>2</td>
<td>348</td>
<td>Television</td>
<td>712</td>
</tr>
<tr>
<td>3</td>
<td>439</td>
<td>Electrical Connectors</td>
<td>408</td>
</tr>
<tr>
<td>4</td>
<td>257</td>
<td>Active Solid-State Devices (Transistors, Solid-State Diodes)</td>
<td>374</td>
</tr>
<tr>
<td>5</td>
<td>362</td>
<td>Illumination</td>
<td>374</td>
</tr>
<tr>
<td>6</td>
<td>280</td>
<td>Land Vehicles</td>
<td>355</td>
</tr>
<tr>
<td>7</td>
<td>365</td>
<td>Static Information Storage and Retrieval</td>
<td>346</td>
</tr>
<tr>
<td>8</td>
<td>70</td>
<td>Locks</td>
<td>340</td>
</tr>
<tr>
<td>9</td>
<td>360</td>
<td>Dynamic Magnetic Information Storage or Retrieval</td>
<td>313</td>
</tr>
<tr>
<td>10</td>
<td>482</td>
<td>Exercise Devices</td>
<td>311</td>
</tr>
</tbody>
</table>
Understanding the idea of (short) Cycle Time of Technologies

1) It is not about sectors but more about technologies, cf) similar to activities in SS

So, If you keep entering new short cycle tech. based business and then will end up diversified

so it is not about fixed list of sectors but rather abstract/theoretical concept

2) Also, not just manufacturing, but include services eg) IT services in India, Uruguay, Philippines

3) Practically, consistent with the idea of asking always "what is next", seeking new industries/businesses but opposite to the idea of keeping doing the usual businesses
Understanding 2: (short) Cycle Technologies

1) What matters fundamentally is not short or long cycle but low or high entry barriers 
   (eg) feasibility to enter to make money in niches):
   - Most of other criteria (except Lin’s) missed this point, which is so critical for late-comers /entrants.

2) So, consistent with the idea of ‘Window of opportunity’ which enable ‘leapfrogging’ into new/emerging technologies/businesses;
   = not only gradual entries/shortening but also radical jump (cf; long jump in Hidalgo et al. 2007);

-- Window of Opportunity = moment when entry barriers get low or entry ports are opened up;
-- can be both intra-sector and inter-sector entries.
Implementing SS with Short cycle tech.
how to choose ‘activities’
out of sectors (long or short cycle)

1) Organize a **private-public joint taskforce**, and to conduct a survey to, and consultation with, private firms,
-- asking the types of business items or technological areas they see near-future potentials,
-- and what are the opportunities, risks, and bottlenecks in entering.

2a) **to identify those activities where private sectors see market potentials but facing some technological, financial and other environmental (regulations) uncertainties.**

2b) Usually could be the sectors or business items which corresponds to shorter ( or longer) cycle technologies than the current businesses,

3) Then, policy intervention to promote these identified areas by mobilizing public and private resources, correcting market and coordination failures.
An example of Ent. Discovery in Korea?

Bottleneck technology Development for SMEs
Industrial Base Technology Development Projects (IBTDPs, 1987-91)

• the shift
  - from the sector-sector
to functional promotion type industrial policy

• to develop the so-called bottleneck technologies common to the SMEs,
• preferably in the form of the tripartite joint R&D by the private-academic-public labs.

• To identify by surveys to firms.
### Outcomes of the Survey to identify the ‘needed’ industrial technologies

<table>
<thead>
<tr>
<th></th>
<th>1986</th>
<th>‘87</th>
<th>‘88</th>
<th>‘89</th>
<th>‘90</th>
<th>‘91</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of technological areas</strong></td>
<td>219</td>
<td>185</td>
<td>225</td>
<td>102</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td><strong>The number of experts involved the surveys</strong></td>
<td>818</td>
<td>981</td>
<td>852</td>
<td>492</td>
<td>1,205</td>
<td>1,416</td>
</tr>
<tr>
<td><strong>number of the participating firms</strong></td>
<td>585</td>
<td>733</td>
<td>724</td>
<td>535</td>
<td>1,107</td>
<td>5,994</td>
</tr>
<tr>
<td><strong>A Total number of technologies identified for projects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No of technologies identified to be developed</td>
<td>581</td>
<td>562</td>
<td>564</td>
<td>417</td>
<td>638</td>
<td>947</td>
</tr>
<tr>
<td>No of technologies needing further guidance &amp; assistance</td>
<td>118</td>
<td>168</td>
<td>117</td>
<td>56</td>
<td>105</td>
<td>217</td>
</tr>
<tr>
<td>No of technologies to be imported</td>
<td>837</td>
<td>202</td>
<td>202</td>
<td>46</td>
<td>75</td>
<td>165</td>
</tr>
<tr>
<td>total</td>
<td>1536</td>
<td>932</td>
<td>883</td>
<td>519</td>
<td>818</td>
<td>1,329</td>
</tr>
</tbody>
</table>
Small vs. Long Jump (leapfrogging): Near spaces vs. far spaces

• With low levels of capa.
  -- “small jump” within existing sector or related fields.
  -- intra-sector diversification

• With higher capabilities, try Long jump/leapfrogging, esp with new windows of opportunities.
  -> inter-sector diversification (eg. Nokia)

Eg) Taiwanese firms: a long jump from small calculators into notebooks in the 1980s; with R&D done by ITRI (a public lab)
In sum, Industrial Policy is

1) Not picking winner but
   a) picking winning markets and coordinating entries into that markets
   b) but picking good students and matching them with good teachers

2) Should avoid both target and design failures; and balancing supply and demand side interventions

3) Not a zero but a positive sum game for global public goods
   (like better environment-saving tech, with global market failure)
Thank you!

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From Short cycle to Long cycle Technologies:

The 2\textsuperscript{nd} Transformation of Industrial Structure at the Post-Catch-up Stage in Korea
eg) BioSimilar by Samsung

(b/c short cycle tech is easy to catch up but also easy to be caught up (by China); long cycle tech => still higher profit margin)
Two Tech. Turning Points and the Korean Detour (path-creation)
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