Explaining enterprise competitiveness in emerging economies

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Technological capability is key

- The mainsprings of competitive advantage are to be located in technological capabilities

- Firm level capabilities draw on
  - policy or institutional features

Major economies share of world GDP (0-2005)

Source: Angus Maddison (2001) in Saul Eslaske

Trade and technology theories: partial explanations

- Static optimization type trade (& growth) theories
  - H-O
- New trade theories
- Neo-technology theories (IPC, FG etc.)
- Competitive advantage of nations
  - Porter (1990)

How is capability created in the first place, as distinct from production capacity?

Technological Capabilities (TC) – shift from statics to dynamics

- Evolutionary-revisionist explanations (microeconomic)
- Learning-absorptive capacity, competency and capability theories
    - Principally a focus on a micro-macroeconomic explanation of firm level capabilities
- TC approach – Structuralist – Institutionalist – Statist
    - Leading examples – latecomer industrialisers/Asian Tigers/HPAE (Korea, Taiwan, Singapore)
  - *Linkage-versus-learning approach
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Neoclassical versus Evolutionary Views of Technological Capabilities

- Neoclassical: Technology is freely available to all firms and is shared equally.
- Evolutionary: Technology is not freely available, requires learning many tacit elements.

Technology Creation and Diffusion Assumptions

- Neoclassical: Instantaneous, costless learning.
- Evolutionary: Deeper technological capabilities are learning-prone to market failure.

Mode of Transfer

- Neoclassical: Modes of transfer not important.
- Evolutionary: Modes of transfer does matter.

Strategic Capabilities

- Neoclassical: Product and factor markets respond to each other.
- Evolutionary: Product and factor markets do not give right signals for investment.

Technology Development

- Neoclassical: Static view of technology development.
- Evolutionary: Technological development as a dynamic, continuous process.

Strategy of Intervention

- Low technology: Low entry barriers, slow growth of demand, small productivity increases, low learning potential, tentative linkages.
- Technology intensive: High entry barriers, fast growth of demand, big productivity increases, higher learning potential, better linkages and collective learning.

Levles of Technological Capability & Absorptive Capacity

- Innovative: Ability to develop new generation system.
- Adaptive: Ability to expand output without foreign assistance.
- Duplicative: Ability to manage/operate.
- Basic: Ability to duplicate.

Japan, Korea, and Taiwan

- Market supporting rather than market replacing.
- Governments in Japan, South Korea, and Taiwan coordinated, guided, and subsidized investment:
  - Industrial policy
  - Technology policy
  - Trade policy (strategic)

Dynamic Capabilities in East Asia

- Shares of Technically Advanced Products in Manufactured Exports (%)

- Technologically advanced exporters: Singapore, Malaysia, Taiwan, and Korea.
- Hong Kong has the lowest technological content among Tigers.
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Local effort and R&D expenditures

- Japan (3%), Korea (2.7%), Taiwan (2.7%), Singapore (3%), Malaysia (0.4%)
- Korea’s private R&D is the highest in the world!

R&D Expenditures

<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>% of GDP</th>
<th>R&amp;D per capita</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hong Kong</td>
<td>1995</td>
<td>0.1</td>
<td>N/A</td>
</tr>
<tr>
<td>Japen</td>
<td>1994</td>
<td>0.3</td>
<td>N/A</td>
</tr>
<tr>
<td>Singapore</td>
<td>1992</td>
<td>0.7</td>
<td>N/A</td>
</tr>
<tr>
<td>Korea</td>
<td>1995</td>
<td>2.7</td>
<td>237.1</td>
</tr>
<tr>
<td>Taiwan</td>
<td>1993</td>
<td>1.7</td>
<td>179.6</td>
</tr>
<tr>
<td>Malaysia</td>
<td>1992</td>
<td>1.2</td>
<td>19.9</td>
</tr>
<tr>
<td>Thailand</td>
<td>1991</td>
<td>0.1</td>
<td>6.1</td>
</tr>
<tr>
<td>Indonesia</td>
<td>1993</td>
<td>0.2</td>
<td>30.3</td>
</tr>
<tr>
<td>Some OECD Countries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Japan</td>
<td>1995</td>
<td>3</td>
<td>1225.6</td>
</tr>
<tr>
<td>France</td>
<td>1994</td>
<td>2.4</td>
<td>54.3</td>
</tr>
<tr>
<td>Germany</td>
<td>1991</td>
<td>2.4</td>
<td>674.8</td>
</tr>
<tr>
<td>UK</td>
<td>1994</td>
<td>2.2</td>
<td>383.6</td>
</tr>
<tr>
<td>USA</td>
<td>1995</td>
<td>2.4</td>
<td>655.2</td>
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</table>


Technological Capabilities (TC)

- Appropriate technologies for BoP?
- What can we borrow from TC model?
  - From New Trade Theory (Intra-Industry trade)?
  - From competitive advantage (Diamond framework)
  - Structuralist – Institutionalist framework?
- Focus on cost leadership and process engineering – simple in scope (reverse engineered low cost goods)
- Focus on institutional environment

Human Resources

<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>NonScience</th>
<th>Science</th>
<th>Engineering</th>
<th>Maths</th>
<th>Other</th>
</tr>
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<tbody>
<tr>
<td>Japan</td>
<td>1995</td>
<td>30.5</td>
<td>40.5</td>
<td>20.5</td>
<td>15.5</td>
<td></td>
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<tr>
<td>France</td>
<td>1994</td>
<td>24.5</td>
<td>45.5</td>
<td>20.5</td>
<td>10</td>
<td></td>
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<tr>
<td>Germany</td>
<td>1991</td>
<td>23.5</td>
<td>40.5</td>
<td>20.5</td>
<td>15.5</td>
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<tr>
<td>UK</td>
<td>1994</td>
<td>22.5</td>
<td>38.5</td>
<td>20.5</td>
<td>15.5</td>
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<tr>
<td>USA</td>
<td>1995</td>
<td>24.5</td>
<td>55.5</td>
<td>20.5</td>
<td>15.5</td>
<td></td>
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</tbody>
</table>

Notes: (a) all technical subjects include three categories earlier plus medical, architecture, trade and crafts, transport and communications

The case of India

- There are at least two models of innovation in emerging market firms
  - Global value chain
  - Autonomous
    - Reverse engineering and
    - Architectural innovation

The case of Telecom

- The abundance of well-qualified manpower assisted in innovating a switch for US$28 million only, compared with Alcatel and Siemens, which spent $1 billion and $1.3 billion
  - software was 75% of the cost of developing the switch, and documentation constituted about 25 per cent of the costs of equipment
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**Telecom: emerging world in the new century**
While MNCs are pouring billions into 3.5-4G technologies

C-DoT has emerged as the leader in

- Rural broadband
- Broadband wireless

**The Indian Pharmaceutical Industry**
Crafting characteristics of the business model to match the features of the environment

- Relevant technologies and products
- Produced with local raw materials and know-how
- Labour intensive rather than capital intensive
- Export orientation
- Entrepreneurial approach

**Drug Prices: An Inter-Country Comparison – 1992 (Rupees)**

<table>
<thead>
<tr>
<th>Drug</th>
<th>Unit</th>
<th>India</th>
<th>Pakistan</th>
<th>Bangladesh</th>
<th>Sri Lanka</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chloramphenicol</td>
<td>250mg</td>
<td>16.78</td>
<td>21.74</td>
<td>31.86</td>
<td>44.76</td>
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<tr>
<td>Metronidazole</td>
<td>200mg</td>
<td>6.55</td>
<td>12.04</td>
<td>19.3</td>
<td>29.15</td>
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<tr>
<td>Furosemide</td>
<td>15mg</td>
<td>20.34</td>
<td>6.52</td>
<td>7.30</td>
<td>8.95</td>
</tr>
<tr>
<td>Diclofenac</td>
<td>50mg</td>
<td>15.77</td>
<td>6.44</td>
<td>8.97</td>
<td>10.52</td>
</tr>
<tr>
<td>Propylthiouracil</td>
<td>10mg</td>
<td>3.71</td>
<td>10.06</td>
<td>1.79</td>
<td>3.91</td>
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<tr>
<td>Sulphadoxine-Pyrimet</td>
<td>25mg</td>
<td>4.39</td>
<td>3.59</td>
<td>6.62</td>
<td>5.78</td>
</tr>
<tr>
<td>Atorvastatin</td>
<td>10mg</td>
<td>3.75</td>
<td>40.92</td>
<td>32.26</td>
<td>48.52</td>
</tr>
<tr>
<td>Omeprazole</td>
<td>20mg</td>
<td>3.52</td>
<td>10.06</td>
<td>34.9</td>
<td>106.72</td>
</tr>
</tbody>
</table>


**The Indian Pharmaceutical Industry - model based on reverse engineering**

- The infant entrepreneur argument
- Allowed LEs to introduce any latest drug by reverse engineering
- Engendered both duplicative and adaptive capabilities
- Technological ‘deepening’
- By the 1980s, large Indian firms could produce most new drugs of MNCs within two years of their international launch

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