Catching Up or Breaking Out? Capability Development Strategy of Latecomer Firms and Nations

Poh Kam Wong
Professor, NUS Business School
Director, NUS Entrepreneurship Centre
Outline

• Renewed Interest in “Technological Catch-Up”
• Brief Review of Technological Catch-Up literature
• Why the Catching-Up Metaphor could lead to conceptual “framing bias”
• Towards a Broader Framing: Path-Following vs. Path Breaking Modes of Learning, Technology Performance Attributes & Market Fit
• Some illustrative examples
• How policies/institutions and entrepreneurial motivations shape the selection of capability development pathways
“Technological Catching Up” is back in vogue...

• Growing concerns with "Middle Income Traps“ and renewed interest of development literature on how latecomer firms in developing nations can catch up with leading firms in advanced economies

• Growing business management literature on “catch-up” challenges faced by firms from emerging markets, especially China
Early Literature on Technological Catch-Up

• Pioneering work by Gerschenkron (1962) and Abramovitz (1986) sought to understand the challenge of *late* industrialization of various European economies; emphasis on structural change and financing of technological investment (Gerschenkron) and social capabilities and technological congruence (Abramovitz)

• The Developmental State: focus shifted to the role of the state in the rapid industrial capability development of Japan and the East Asian NIEs (Johnson 1982, Amsden 1989, Wade 1990)

• Neo-Schumpeterian Perspective: Techno-economic paradigms and Windows of Opportunities (Freeman & Perez, 1988) for latecomer catch-up
Literature in the 1990s & early 2000s

• The sources of growth debate: “Growth by accumulation” (development through using more resources) (Young 1993, Krugman 1994) vs. “growth by assimilation” (productivity growth through technological capability development) (Nelson & Pack 1999)

• Shift of research focus to overall Economic Growth Convergence in the 1990s (see e.g. Baumol, Nelson & Wolff 1994, Maddison 1995, Pritchett 1997, Easterly 2001), although some focus on technological catch-up remains (e.g. Fagerberg & Godinho 2005)

More Recent Literature on Technological Catch-Up

• The rapid rise of China and India in recent years has drawn attention to their technological capability development (see e.g. Dahlman 2008, OECD 2007, Breznitz & Murphree 2011), and a renewed interest in industrial policy and capabilities accumulation in developing economies in general (see e.g. Cimoli, Dosi & Stiglitz (Eds) 2009, Figureiredo 2010, Spence 2011, Stiglitz, Lin & Esteban(eds) 2013, Nayyar 2013)

• Increasing concerns that the process is confined to only a small number of late-comer East Asian economies (Lee 2013); many middle-income economies appear to be stuck in a “Middle Income Trap” (ADB 2012, World Bank 2013), while the majority of developing economies risk falling further behind (Rodrik 2012)
The Latecomer Catching Up Challenge?

- The “easy” phase of “growth by accumulation” is over; the next phase of “growth by assimilation” is harder
  - Competitive advantage is shifting from low resource cost to technological capability
  - But technological frontiers are advancing rapidly, and most developing countries are already “late” in entering the technology capability development race

- Without closing the technological gap - catching up – the latecomer firms and nations will be stuck with low-resource cost competition & the “Adding Up” Problem

- Hence the “Middle-Income” Trap hypothesis
Latecomer Disadvantages vs. Advantages

• Latecomer Disadvantages:
  – Experience/Learning Curve advantages of first movers
  – Brand & intellectual Property entry barriers
  – Goliath vs. David
  – “Kicking Away the Ladder” by the incumbent leaders, etc
  – Inferiority Complex

• Latecomer Advantages:
  – Knowledge “Spillover”
  – New Technological Waves destroying incumbent technological advantage or offering new level playing fields
  – More Hungry, Work Harder
  – Complacency & hubris of the leaders, etc
Technological Catch-Up: Framing Bias?

• Technology Gap and Catch-Up Framing
  – “the falling of the relative technology gap between a less
devolved country and the Technology Frontier is what is
meant by (international or technological) catching-up” (Gomulka, 1987: 379)

• Limitations of the Latecomer “catch-up” metaphor?
  – An implicit linear view of the technological catch-up
process and the “path-following” mode of learning
  – “Path Breaking” Innovation is only possible after one has
gotten close to the leader
  – Strategic Framing Bias that focuses on competing with
the leaders, excludes other form of learning and
innovation, and reinforces the early-mover advantages of
the incumbent leaders
A Broader Conceptual Framing of the Latecomer Technological Learning & Innovation Process

- Types of Technological Capability
- Path-Following vs. Path-Breaking Mode of Learning
- Technology as a Vector of Performance Attributes and their Market-Fit
- Technological vs. Business Model Innovation
TECHNOLOGICAL CAPABILITY

• **Types** of Technological Capability
  – Ability to **Use**
  – Ability to **Imitate (Replicate)**
  – Ability to **Innovate**

• **Product vs. Process** Technological Capability
  – Ability to create/design the product
  – Ability to make (multiple copies) of the products

• **Level vs. Vector of Capability**
  – Every technology has multiple performance dimensions
  – Strategic Positioning relative to technology frontiers
# Path-Following vs. Path-Breaking Learning

<table>
<thead>
<tr>
<th></th>
<th>Path Following</th>
<th>Path Breaking</th>
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<tbody>
<tr>
<td><strong>Learning to Innovate</strong></td>
<td>Incremental; Continuous; Sustaining; Exploitative</td>
<td>Radical; Discontinuous; Disruptive; Explorative</td>
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<tr>
<td><strong>Learning to Replicate</strong></td>
<td>Duplicative Imitation</td>
<td>Creative Imitation</td>
</tr>
<tr>
<td><strong>Learning to Use</strong></td>
<td>Imitative Use</td>
<td>Creative Use</td>
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Generic Technological Catch-Up Strategies

• Reverse Value Chain Migration Strategy (OEM to ODM to OBM/OIM)
• Reverse Product Life-Cycle Strategy (Late-Follower to Fast-Follower to Leader)
• Process Capability Specialist Strategy
• Product Capability Specialist Strategy
Generic Technological Capability Development Strategies of Latecomer Firms

Some Examples of Successful Path-Following Catch-Up

• Samsung’s overtaking of Sony in TV display technology (RLC + leapfrogging)
• How China’s CIMC became the world leader in container industry (RVC)
• How Taiwanese TSMC/UMC became world leader in wafer fabrication and India’s Infosys etc in contract programming (Process Specialist)
• How Singapore’s Creative Technologies became the world leader in PC “sound-card”
# Path Following vs. Path Breaking

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<tr>
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<th>Path-Following</th>
<th>Path-Breaking</th>
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<tbody>
<tr>
<td>Technologically Close to Leader</td>
<td>“Overtaking”; Frontier Leapfrogging</td>
<td>Radical Innovation; Frontier Leapfrogging</td>
</tr>
<tr>
<td>Technologically Far Behind Leader</td>
<td>“Catching-Up”; Learning; Stage-skipping Leapfrogging</td>
<td>Disruptive Innovation; New Market Niche Creation</td>
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Technology Attributes and Market Fit

• Every Technology is a vector of performance attributes; technological improvement/innovation is not movement on a line but in a multi-dimensional space

• Different market applications impose different mix of performance attributes of a technology; different target market strategies will thus require different technological learning and innovation trajectories

• In addition to targeting a different bundle of performance attributes, latecomer innovation may also involve adopting a different business model ("business model" innovation)
## Performance Attributes: Data Storage Technologies

<table>
<thead>
<tr>
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<th>Magnetic HDD</th>
<th>Flash Memory</th>
<th>Cloud Storage Service</th>
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<tbody>
<tr>
<td>Storage Capacity</td>
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<td>Portability</td>
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<td>Access Speed</td>
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<td>Availability</td>
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<td>Cost/MB</td>
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Technological Learning Strategy

Perf Attribute B

Leader

Tech Frontier T1

Tech Frontier T2

Strategy 1

Strategy 2

Latecomer

Performance Attribute A
# How Market-Fit Drives Innovation Trajectories

<table>
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<tr>
<th>Innovation Focus</th>
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<tr>
<td><strong>Low Income/Affordability Level</strong></td>
<td>Cost reduction; “Frugal Innovation” for BOP; Small Packaging; Business Model Innovation</td>
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<tr>
<td><strong>Space Constraints</strong></td>
<td>Miniaturization</td>
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<tr>
<td><strong>Remote Location</strong></td>
<td>Portable solution</td>
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<td><strong>Lack of IP Protection</strong></td>
<td>Rapid incremental innovation &amp; product proliferation; new delivery mechanism</td>
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<tr>
<td><strong>Poor infrastructure</strong></td>
<td>“Juggad” Innovation; Business Model Innovation</td>
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An example of an Innovation driven by space constraints...

The big tank in your bathroom...
Becomes the art shelf in your bathroom... Innovation by Haier
Path Breaking: Technology vs. Market-Fit

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<tr>
<th>New Technology</th>
<th>Existing Market/Application</th>
<th>New Market/Application</th>
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<tbody>
<tr>
<td>New Technology</td>
<td>Disruptive Innovation</td>
<td>Architectural Innovation</td>
</tr>
<tr>
<td>Existing Technology</td>
<td>Path-Following Innovation</td>
<td>Creative Use</td>
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Some Examples of Path Breaking Innovations

• Mohd Yunus’ Grameen Bank micro-finance innovation (“bank for the poor”)
• Mobile App Innovations for BOP markets (e.g. MPESA in Kenya, SMS payment in Philippines)
• How China became the world’s leader in E-Bike Industry
• How Singapore became the world’s leader in off-shore oil rig building
• How Taiwanese MTK became the leading platform for “Shanzhai” phones
Policy/Institutional Environment Shapes Capability Development Pathway Selection...

- Korean “Large Chaebols” tend to pursue RLC catching up strategy
- Taiwan’s indigenous SME promotion strategy lead to proliferations of RVC and Process Specialization
- China’s uncertain IP protection regime enables the emergence of the Shanzhai “creative imitation” system, and the pioneering of “online streaming” vs. packaged software business model
- India’s & Africa’s large BOP market stimulates entrepreneurial development of “frugal innovations”
- Singapore’s (& Hong Kong’s) openness to DFI stimulates development of *Ability to Use* new technologies (early adopter as well as creative user)
...but Entrepreneurial Motivations also matter

• Korea’s “Nationalist” drive to catch-up with Japan (and to a smaller degree, China’s current drive to catch up with the West)
• The “nation-building” motivations of diaspora-returnee entrepreneurs in the technological capability development of Taiwan and Korea
• In contrast, many emerging market economies have attracted *rent-seeking* entrepreneurs, rather than value-creating entrepreneurs, resulting in dependence on foreign technologies with little incentive for indigenous learning
• The role of *Social* entrepreneurs who are driven by the desire to make social impacts, in developing BOP innovations
• Co-evolution of Institutional environment and entrepreneurial strategies, resulting in locked-in path-dependency
The Break-Out Mindset

• Breaking-Out is ultimately as much about *mindset* as rational economic calculation
  – Cultural dominance of the leader
  – Entrepreneurial Orientation (EO) is often suppressed in the process of rapid path-following catch-up

• Countries with State-dominant capability development role tend to pursue path-following catching up strategies; countries where entrepreneurs operate without state help tend to pursue less risky break-out strategies (creative use and creative imitation); more radical break-outs may require a mix of entrepreneurial individuals AND developmental state support; Mindset change is needed in BOTH
Concluding Observations

• Developing economies have opportunities to pursue path-breaking capability development (creative use and creative imitation), even when they are far behind the technological frontiers.

• Likewise, middle income countries may find it easier to overcome the middle-income trap by pursuing more path-breaking opportunities in the emerging markets, rather than focusing solely on path-following catch-up learning, which leads to direct competition with the advanced economies.

• ...But the development of such path-breaking capabilities requires the “Break-Out” mind-set to become more widespread.
Thank You !