

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

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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)
- Increasing literature on the role of technological catch-up in the rapid economic growth performance of the Asian NIEs (see e.g. Kim 1997, Shin 1996, Lall 2000, Kim & Nelson(eds) 2000, Hobday 1995, Mathews 2002, Chang 2003, Amsden & Chu 2003)

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 developed 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

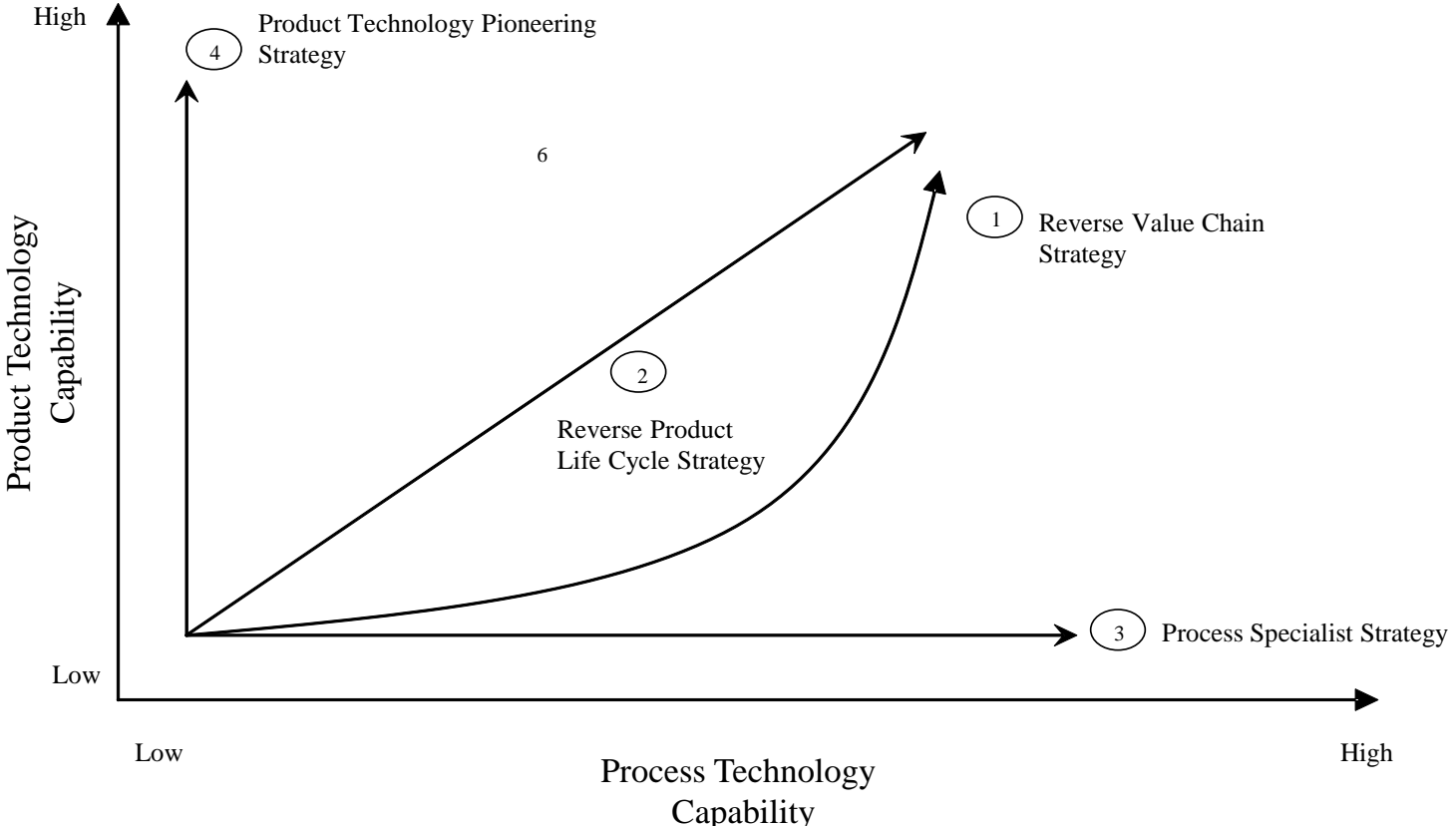
Path-Following vs. Path-Breaking Learning

	Path Following	Path Breaking
Learning to Innovate	Incremental; Continuous; Sustaining; Exploitative	Radical; Discontinuous; Disruptive; Explorative
Learning to Replicate	Duplicative Imitation	Creative Imitation
Learning to Use	Imitative Use	Creative Use

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



Source: Wong Poh Kam (1999)

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

	Path-Following	Path-Breaking
Technologically Close to Leader	“Overtaking”; Frontier Leapfrogging	Radical Innovation; Frontier Leapfrogging
Technologically Far Behind Leader	“Catching-Up” Learning; Stage-skipping Leapfrogging	Disruptive Innovation; New Market Niche Creation

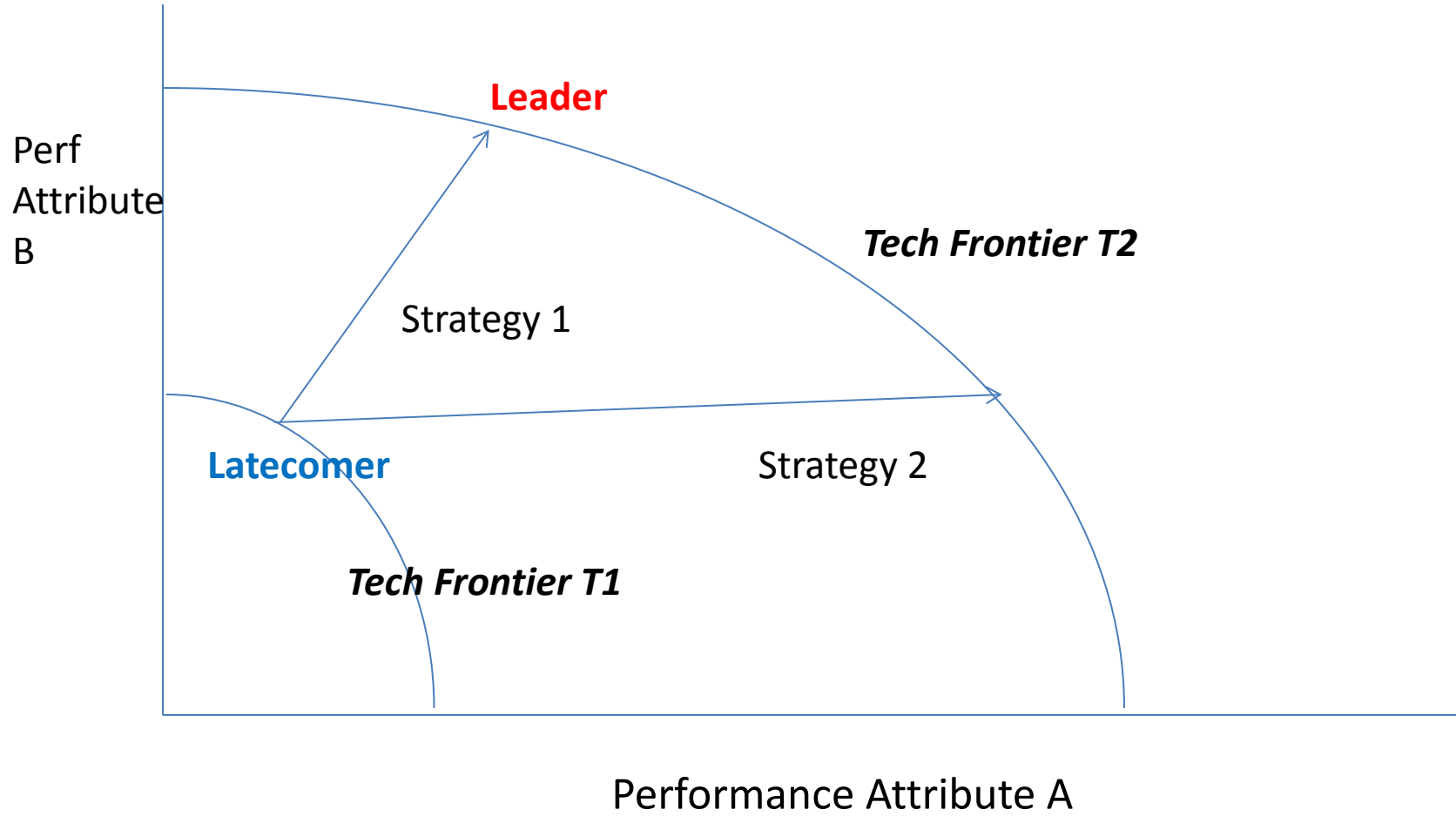
Technology Attributes and Market Fit

- 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

	Magnetic HDD	Flash Memory	Cloud Storage Service
Storage Capacity			
Portability			
Access Speed			
Security			
Availability			
Cost/MB			

Technological Learning Strategy



How Market-Fit Drives Innovation Trajectories

	Innovation Focus
Low Income/ Affordability Level	Cost reduction; “Frugal Innovation” for BOP; Small Packaging; Business Model Innovation
Space Constraints	Miniaturization
Remote Location	Portable solution
Lack of IP Protection	Rapid incremental innovation & product proliferation; new delivery mechanism
Poor infrastructure	“Juggad” Innovation; Business Model Innovation

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

	Existing Market/ Application	New Market/ Application
New Technology	Disruptive Innovation	Architectural Innovation
Existing Technology	Path-Following Innovation	Creative Use

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 !