Role of 'corporate persistence' and 'environmental support' in building breakthrough capability: Empirical investigation of Samsung's initiatives in memory and microwave oven business

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Abstract

It is now an incontrovertible fact that capabilities are the source of competitive advantage. However, the process through which firms build capabilities over a period of time is only partially understood. Concepts like learning, resource combination, and co-evolution can be categorized as enablers as they support capability formation. On the other hand, concepts like inertia and path dependence can be categorized as restrictors as they constrain the process of capability formation. Combined together, while these concepts hint in the right direction, there is a need to have concepts that explain the process of capability formation holistically. An endeavour towards this objective would require taking into account the role of internal and external events. This paper builds concepts of 'corporate persistence' and 'environmental support' to explain their role in building breakthrough capability by examining major events in the evolution of two mega high technology business belonging to the Samsung group.

Keywords: Capability Building, Corporate Persistence, Environmental Support, Breakthrough

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Introduction

The word 'breakthrough' connotes multiple interpretations. It means making an important or notable discovery, penetration of a barrier, a profound insight or a sudden advance especially in knowledge or technique. Literature on innovation and entrepreneurship identify 'breakthroughs' as essential for a firm's growth. In strategy literature, process studies have adopted methodology of studying 'key events'.

Resource based view literature (Barney, 1991) link possession of superior resources and capabilities to competitive advantage. Earlier research has identified examples of capabilities viz. technological capabilities, knowledge integration capabilities (Grant, 1996) etc. which confer competitive advantage. However, the process to realize i.e. to build capabilities and then to sustain competitive superiority over time is not very well understood (Helfat and Petraf, 2003). Dynamic capabilities that enable firms to introduce new products and processes and adapt to changing market conditions play an important role (Teece et.al., 1997; Helfat, 1997) in building of capabilities. Since, capabilities are more likely to emerge during periods of greater turbulence and organizational change (Wernerfelt, 1984) firm capabilities evolve as a result of firm response to competitive environment (Levinthal and Myatt, 1994). Capability building process has so far remained unresolved puzzle both for the researcher and the practitioner. For the researchers it means, a phased process, several learning mechanisms, and innate rigidities associated with the development process. The practitioners on the other hand tend to

associate business growth with development of capabilities. Further confounding them are the numerous theoretical complex models and concepts. This gap needs to be bridged. Literature on innovation, entrepreneurship suggest that 'breakthroughs' play an important part in a firm's growth. In strategy literature, process studies have adopted methodology of studying 'key events'. Apparently, breakthroughs are very significant events for a firm, especially for growing firms and therefore we find them as important links to study the process of capability building. Breakthroughs signify clearing of supposedly difficult hurdles for the organization. Since capability building has hitherto been conceptualized as an incremental, cumulative process there could be a tendency to call each action as a capability in itself. In contrast, breakthroughs which occur from interaction of external and internal events reflect culmination of these incremental accumulations and thus provide better hold and understanding of capability formation. While capability literature has addressed issue of building capability from various perspectives (learning, cognition etc), to our knowledge there is no study which adopts approach of using 'breakthroughs' to examine this process. Furthermore, breakthroughs are a good way to study how organizations through their actions overcome or exploit constraints and opportunities posed by the environment (Hrebiniak and Joyce, 1985). In this paper, we attempt to find answer to the question of how do we explain instances wherein firms have rapidly built technological capabilities in high technology area. We use concept of breakthrough to explain this phenomenon and in the process achieve the following.

Korean firms' ascendance in the area of high technology has been the topic of interest for many studies. Most of these have attributed it to country specific advantages like low wages and government support. We adopt a different approach by looking at Samsung's microwave oven initiative and its DRAM (Dynamic Random Access Memory) chip

initiative from the point of view of successful development of capability to create succession of breakthroughs by harnessing internal and external (environmental) strengths.

Firms achieve capabilities to create series of breakthroughs which spur the process of organizational growth and can be captured in key events in the history of the organization. In this paper we study patterns of breakthroughs which emerge out of growth from the key actions, initiatives, and events in the life of an organization. More importantly, we identify constructs which facilitate emergence of a sequence of breakthroughs resulting into development of a breakthrough capability. We conceptualize breakthrough capability as a progression of series of breakthrough outcomes culminating out of the interactive effect of internal actions and external support. We also develop a typology of breakthroughs in capability building process, identify antecedents for each type of breakthrough, examine consequence/impact of breakthroughs on capability building process and study process of development of each type of breakthrough.

We hope that this simple conceptualization of breakthrough capability as a progression of series of outcome will not only enrich the capabilities literature, but also provides an anchor point to the practitioners to monitor and direct the process of capability building.

This paper is organized as follows. In the first section, we review the literature on (a) the concept of breakthroughs as discussed in different strands of management literature, (b) capability and capability building process with focus on technological capabilities. Next, we highlight the importance and relevance of studying cases in a single organizational context to chart out process of capability building. In the third section, we present two cases wherein we use this 'Key Event technique'. Based on categories created in the third

section, in the fourth section we build a model of building capabilities for creating breakthroughs. Fifth section discusses important constructs which are determinants of breakthroughs and also typology of breakthrough which gets created from the interaction of internal and external factors. Next, we conclude by highlighting the contribution and future research possibilities.

2. Breakthroughs: Multiple interpretations

The concept of breakthrough has been used both explicitly and implicitly in numerous ways. In strategy driven organizations, breakthroughs is a means to execute strategy. Managers implement strategy with focus on long term achievements. Success of long term strategies is measured by short term successes coined as breakthroughs. This managers use it as a strategy implementation technique these breakthrough projects (Hippel, 1999) are essentially team based, goal oriented, and metric focused and disciplined processes. It helps organization to locate hidden potential and address bottom line goals. The process requires engaging key constituents of the organization.

Literature on innovation has examined preferred conditions for emergence of breakthroughs. Empirical evidence has shown that it occurs in both new entrants as well as in incumbents. On the process of achieving breakthroughs, while innovation literature has looked at processes (routines) underlying 'breakthrough' innovations, the approach has been that of treating them as a single event. Whereas when we are looking at the issue of organizational capability to generate several breakthroughs over a period of time there is a need to examine linkages across several such breakthroughs. For companies trying to succeed in high technology areas, breakthroughs can act as excellent catapult points, especially as in innovation literature, breakthrough inventions are considered as source for new technological trajectories and paradigms. In fact breakthroughs are important part

of the process of creative destruction in which extant techniques and approaches are replaced by new technologies and products. Technological breakthroughs can serve as internally generated opportunities for corporate reinvention, business growth, and new business development (Burgelman, 1983)

The importance of breakthroughs has also been highlighted in entrepreneurship literature. The field seeks to understand how opportunities to bring into existence "future" goods and services are discovered, created and exploited, by whom, and with what consequence (Venkataraman, 1997). Such a line of inquiry holds huge promises for building process of capability building.

Literature has made distinction between invention and innovation (Schumpeter, 1934) with the latter associated with commercialization of innovation. This paper doesn't make any such distinction and our concept of 'breakthrough' encompasses both invention and innovation. Rather, we are more interested in antecedents of each breakthrough event and its impact on the process of capability building. Further, in inventions (or innovation) literature, radical or breakthrough invention have been looked at both from technological and market perspective depending upon the importance of the invention for either of the two. For example, Rosenkopf and Nerker (2001) focus on technological importance. However, in this paper, we include both the perspectives and define breakthroughs as those events that serve as the basis for further development of final objective viz. to build a memory business or to develop capacity to build Microwave oven of internationally acceptable quality.

Breakthroughs start with an idea, companies adopt some process to pursue that idea, at some stage there may be sheer madness in it. This result into some capabilities and achievement of objectives reflected in tangible outputs. The role of environment comes because firms all the time could be fighting a constraint after spotting an opportunity

3. Capabilities

The concepts of capabilities and resources with their focus on idiosyncratic characteristics of firms are founded on the seminal work of Selznick (1957), Penrose (1959), Chandler (1962) and Andrews (1971). Selznick (1957) used the term 'distinctive competence' to refer to things that an organization does better than its competitors and one that emerge as institutionalization proceeds. Penrose (1959) conceptualized firm as a bundle of productive services available to it from its own resources, especially the ones that are available from management with experience within the firm. Chandler (1962) who studied evolution of large American firms reasoned that the expansion undertaken by these firms was in response to excess capacity (resource) available with them. Andrews (1971) further strengthened the concept of distinctive competence by distinguishing between what organizations could do and what they do well relative to their competitors.

Wernerfelt (1984) emphasized dynamic resource management by arguing that most resources can be used in multiple products and firms need to keep growing their resources viz. technological capabilities in order to protect their position. Since then, several authors (Barney, 1986 &1991; Diericks and cool, 1989; Grant, 1991; Amit and Shoemaker, 1993, and Petraf, 1993) have taken the field further forward. The field has got enriched by contributions from several studies with different focus and approach. For example, studies with evolutionary perspective (Nelson & Winter, 1982; Winter, 2000

and Helfat, 2000) have analyzed the way companies adapt to the changing environment and build capabilities; Studies with focus on dynamic capabilities (Teece, Pisano & Shuen, 1997 and Eisenhardt & Martin, 2000), have highlighted the strategic value of higher order capabilities which facilitate the generation and reconfiguration of other capabilities; studies on impact of institutional environment on strategic responses (Oliver, 1991); studies with competence based orientation (Sanchez & Heene, 1997) have looked at process of generation and development of competencies; and studies with knowledge based theory (Kogut and Zander, 1992; Grant, 1996; Crosson & Berdrow, 2003) as their base have emphasized on organizational learning.

Winter (2003) defined organizational capability as a high-level routine (or collection of routines as conceptualized by Nelson and Winter, 1982) that, together with its implementing input flows, confers upon an organization's management a set of decision options for producing significant outputs of a particular type. Sanchez and Heene (1997) defined competence as an ability to sustain the coordinated development of assets in a way that helps a firm to achieve its goals.

Thus a plethora of definitions and conceptual frameworks exist and it is left to the researcher to decide on the definition which he feels most appropriate for his research questions.

This brings back our focus on process of asset accumulation. In fact one key focus of firm's strategy should be on making appropriate strategic investments with a view to accumulate required resources and skills Chandler (1990). He argued that in order to develop organizational capabilities, firms need to make investment in three areas:

investment in production to achieve economies of scale and scope; investment in product specific marketing, distribution, and purchasing networks; and investments in managerial talent and management structure to plan, coordinate, and monitor the firm's dispersed operations. This essentially means that it is possible for firms to build privileged asset position. However, sustainability would depend on how easy or difficult it is to replicate or substitute that position. Dierickx and cool (1989) identify four characteristics associated with process of stock accumulation that makes imitation or substitution of capabilities difficult to achieve. These are time compression diseconomies-capabilities like R&D take longer time to build; asset mass efficiencies-firms with high level of existing asset stock are in a better position to make further breakthrough; interconnectedness of Asset stocks- importance of complementary stocks; Asset erosion-stocks decay in absence of commensurate maintenance investments; and causal ambiguity-inability to identify, specify or control factors of resource/capability accumulation process. Lippman and Rumelt (1982) call causal ambiguity as 'uncertain imitability' which acts as a barrier to imitation even in a perfectly competitive industry setting.

However, we are interested in building capability building theory from a perspective wherein firms face barriers in this process. Since, firms vary in their endowments; the fundamental basis of development is different. Therefore, in terms of forward movement, firms have to overcome barriers. We call these breakthroughs. These breakthroughs which represent firms' movement from one barrier to another barrier require significant efforts on part of the firm and /or support from the environment. As focus of this paper is on high technology firms, we now briefly discuss the issue of technological capability to understand its meaning, scope, and relevance to capability building process.

Technological Capability

Firms operating in high technology areas need to possess strong technological capabilities. Technological capability has been defined in numerous ways. For instance, Bhaduri & Ray (2004) categorize technological capability as know-how and know-why. Firms develop 'Know how' capabilities through assimilation of imported techniques and strict quality control. This entails apart from investment in importing technology also changes and modification in current plant configurations. A change of this type leads to greater production efficiency. However, mere improvements in efficiency may not suffice and therefore firms need to also focus on innovative capabilities. Such capabilities come from the next stage of technological development which involves understanding the nature of process and product technologies leading to better products and processes. Clearly, reduction of marginal cost may not be the overriding, or even an important, consideration for such know-why-oriented technological activities

Technological capabilities to solve complex problems require information and skills – technical, organizational and institutional – that allow productive enterprises to utilize equipment and information efficiently. Capabilities which allow complex problem solving capabilities represent a form of institutional knowledge that is made up of the combined skills and experience of its members' (Lall 1995). However, to understand the concept of technological capability it is important to broaden the definition of technological progress to include all possible technological changes that generate economic value. These include not only technological breakthroughs or major innovations, but also minor innovations arising out of absorption and adaptation of given (imported) technologies. Here the innovative capabilities measured by a firms capacity to

make radical product and process modifications, to carry out in-house research and development, and to invent new products and processes plays the most vital role. Studies on development of technological capabilities have highlighted the importance of a firm's internal processes, its institutional infrastructure, other firms with which the firm in question interacts, sources in the public domain and international sources. Indeed, the international competitive strength of Japan's automobile industry and Korean semiconductor industry has been attributed to their capability to invent around processes or designs, which evolved out of conscious long-term research effort on creating know-why capabilities.

4. Methodology: Case Study

Case study is an appropriate method of empirical inquiry when the phenomenon to be studied (in this case Breakthroughs and organizational capability development) cannot be easily separated from their organizational context (Yin, 1989). A common industrial context also facilitates control for relevant external influences such as the degree of environmental regulation and industry-wide common practices. For this paper, we have drawn empirics on capability development from two published cases two divisions of Samsung group. A cross case comparison within the same company's context would help to identify patterns in capability development. Case comparisons enable investigation of the 'what' and 'how' questions (Yin, 1989), such as what are the different types of external and internal breakthroughs which influence capability formation? What are the antecedents and consequences of these breakthroughs How do these breakthroughs influence the process of capability development? Comparative case studies of organizations within the same industrial context facilitate comparison through replication of results, either literally (when similar responses emerge) or theoretically (when contrary

results emerge for predictable reasons), to enable 'analytic generalization' (Yin, 1989). We use the several documented cases of Samsung (Seigal and Chang, 2005; Mathew and Cho 1999; Magaziner and Patinkin, 1989) and the secondary sources like the annual reports and internet website of the company.

5. Empirics drawn from

5.1 Samsung Microwave: Tracking breakthrough events

Samsung Electronics and appliances division transformed itself from being a producer of shabby goods to being one of the largest and the best producer of Microwave oven. How did this transformation happen? In 1977, it had no competence, no expertise, and no technology to build microwave ovens. However, by 2005, Samsung had come to occupy an enviable position among the producers of Microwave ovens. This raises an important question, which is what type of capabilities did the firm built to reach this position and more importantly, how these capabilities were built. In global microwave business, quality and low cost are the two main prerequisites for success. There is some minimum quality which customers expect. Also, the product needs to be customized as per the eating habits of people/region. Price is equally important. Thus, firms try to push prices down through both product and process innovation and building scale. In the following paragraphs, we attempt to trace the trajectory which Samsung home appliances adopted for building capabilities to produce microwave oven. Overcoming the handicaps of a late entrant, the company, over a period of twenty years became one of the leading producers of microwave ovens. Despite failures, it persisted in its efforts to build capabilities for producing high quality microwave ovens. Support for these endeavours came not only from the top management of the form but also from the environment in the form of

technology, processes, and trained manpower. Table-1 shows chronology of events during the development of Microwave oven by Samsung.

In 1977, a senior executive of Samsung during his visit to US spotted an opportunity in manufacturing microwave. The idea led to formation of team headed by US educated technically qualified person called Chu. The initiative had full support of top management who anticipated great potential to export ovens. Chu was given unbridled freedom to pursue this venture without bothering about sales. Although, Samsung had minimal expertise to develop microwave oven, it went ahead with the project. Backed by some extraordinary hard work and commitment, the team developed prototype for oven in 1978. The development of prototype was a significant achievement for the company.

Buoyed by their initial success in developing prototype, Samsung invested in building production lines and started parallel marketing efforts. The product quality was also improved and the company obtained approval of Underwriter's lab obtained to export ovens to US market. The development of complementary capabilities helped company to get a small order from J.C Penny located in Panama. Very soon, J.C. Penny placed a repeat order and promised support for improving the product quality further. During this phase, Samsung made effort to make environment (other firms) take notice of them.

However, Samsung's management was not contended with just being a small player. It made huge investments in more assembly lines and building infrastructure like R&D labs. It also acquired magnetron tube facility, a critical component in microwave oven to attain self sufficiency and further reduce the manufacturing cost. Meanwhile, for the existing players, environment turned highly competitive. Deep price cuts were announced by

Japanese manufacturers. Efforts by GE to match Japanese price onslaught failed. This led to a search to find out a low cost producer. Though a little skeptical about Samsung's product quality, GE went ahead and placed a small trial. Very soon, there were more orders from GE. Samsung also benefited from its association with GE in terms of support from their quality engineers. Samsung's production increased to 7,50,000 ovens per year. The events made Samsung a major competitor in the microwave oven business. Since then, Samsung has been trying to explore other markets. It has succeeded in expanding its business but has not been able to become industry leader i.e., to develop distinctive competence of its own.

5.2 Samsung Memory

Semiconductor industry is marked by intense competition, short product cycles, and relentless pressure on price within each short cycle. The case of DRAMs show that standard size chips have undergone numerous changes. With regards to sources of competitive advantage, firms that enjoy good reputation for quality get one percent premium on price. The customers are highly fragmented with no single OEM controlling more than 20% of the global PC market in 2005. Suppliers of ram material offer discounts of up to 5% for high-volume buyers. Thus for a firm, the main challenge in process efficiency is to build scale and generate as many individual chips in one production step as possible while minimizing the number of defective chips. Towards this objective, memory chip producers invest in process capabilities (Know-how capability) which allows them on one hand to work with larger wafer size but at the same time minimize number of defective chips. Also, due to rapid product innovations, firms have to constantly innovate (Know-why capability). Thus a combination of both know-how capability and know-why capabilities are required.

In the following paragraphs, we trace the journey of Samsung electronics from being a non-entity in 1974 to become leading producer of memory chips in 2005. By the early 1990s, Samsung had caught up with the world leaders with its 4 Mbit chip and in 1994; it became the world leader in the production of 16 Mb DRAM. In fact by the late 1990s, 16 Mb chip was the major source of revenue for semiconductor manufacturers. It started with negligible market share in 64 K DRAM and went on to acquire estimated 40% of the world market for 16 Mb DRAMs. Table 2 shows key events, their antecedents and consequences in the development of successive generation of DRAM chip by Samsung.

In 1974, Korea had no semiconductor industry. Only a small startup called Korea Semiconductor Company with neither strong financing nor proprietary technology was producing wafers. Anticipating higher growth in semiconductor business, Samsung group bought this company and merged it with Samsung Electronics at a time when most other Korean firms were investing in steel and heavy industries. The first breakthrough came in the form of “watch chip” used in wrist watches. The breakthrough got recognition and support from the environment – even from the president of South Korea. Convinced by bright prospects for semiconductor business, during the 1980s, Samsung group made Samsung electronics its flagship company and allocated it most of the Group resources. The group was so committed to DRAM business that from 1983 to 1985, even when the global semiconductor business was under severe recession and companies like Intel exited the business, it allocated more than $100 million to DRAM development. It pumped in more money into the business even though it lost money for several years. In the mid-1980s Samsung built its first large manufacturing plant in just six months against schedule of 18 months. Employees used to work non stop week after week in voluntary pursuit of the company’s mission. Since Samsung had no technology to design and

produce its first 64K DRAMs in the 1980s, its executives searched round the globe. They learned production technology from US based company called Micron in exchange for cash. The frontier technology for the next generation of DRAM was developed purely through in-house efforts. The company created internal competition across global R&D sites. The teams were told to be cooperative, but each was to come up with its own solution. Later, this model of competing product development was extended throughout company's operations. By late 1980s, the company had produced 4mbit DRAM. In the process, it compressed development time quite significantly.

When the company faced the dilemma of choosing one of the two technologies being used for fitting cells onto a tiny chip., the final decision to use 'stacking method' by taken by the chairman himself. The decision paid reach dividends to the company later as it catapulted Samsung to number two positions just behind the industry leader Hitachi. The other competitors, IBM, Toshiba, and NEC chose the other technology of 'Trenching' and made multibillion dollar investments in creating specific design routines. However, by the time they realized their mistake, they not only lost years of development time, but also Hitachi had become the industry leader followed by Samsung.

Investment made in earlier phase benefited company later when the capital requirement for a single firm increased several times during the late 1980s and early 1990s. The semiconductor business became the prime source of value for the group. It became a viable competitor[4] in the global memory industry. As of early 1990s, Samsung had joined the industry's top echelon.

[4] Since 1992, semiconductors had been South Korea's largest export, and as of 2004, Korea's semiconductor exports totaled $25.1 billion, roughly 10.4% of the country's export volume. Samsung's share was 22%.

But, Samsung aspired to be number one. To achieve this objective, company devised a plan to increase the size of wafers used and invested $ 1 billion to master 8-inch technology. At that time, no other company was willing to take that huge risk. The decision fetched handsome returns to the company, it gained number one market share in the DRAM industry in 1992.

Since 1992, Samsung has maintained its leadership position even during market lows. It now has the unprecedented ability to produce 1200 different variations of DRAM products.

Table 1: Samsung's initiatives for developing Microwave oven Breakthrough capability

Year	Antecedent Environmental Support	Antecedent Organizational persistence	Breakthroughs	Category	Consequent Environmental Support	Consequent Organizational Persistence
1977 June 1978	- Prior experience in production of home appliances - Advantages of Low wages - Endowments: US educated technical manpower - Large potential US market for micro wave ovens	- Support from company's policy: Priority for production and not profits or marketing in the initial phase - Support from top management - Human capital: Development process driven by hard work of team members and obsession of team leader - Culture: Realization that Samsung lacks expertise to build magnetron tube. Management not deterred by this revelation. Search for suppliers launched. - Management support and commitment: Realization about it being too crude to compete in world market. Still the mood is upbeat and ecstatic	Idea to make Microwave oven for US market Decision to produce Microwave oven for export markets Ist and 2nd Prototype developed	**Entry Breakthrough:** A combination of Discovery , Penetration of Mental barrier and productive insight, Penetration of a barrier	No visible support	Discovery of potential opportunities Conversion of opportunity to action Learning from doing
Mid 1979 1980	- Approval of Underwriter's lab obtained to export ovens to US market - Support from JC Penny for improving product quality.	- Investments in anticipation: In production line for production; in Parallel marketing effort: Formation of marketing team for overseas foray, Hiring of distributors in dozens of countries. Prospective buyers offered heavy price discount and freedom to order any lot size. - Samsung's initial cost was $ 600. Challenge of converting pneumatic assembly room into an efficient factory. Design of new oven. Surety of losses. Managers ecstatic about	Order from Panama for 240 ovens. . Production increased from 10 to 1500 per month. .	**Platform Breakthrough:** Platform for future advancement: preparation for breakthrough, Penetration of a barrier, Sudden advance especially in knowledge and technique	Big order from JC Penny with demand to supply ovens at $ 299 Repeat order from Penny. Ist order for 5000 and 2nd for 7000 ovens per month	- Mood upbeat despite the deal being at a substantial loss. - Seen as a learning opportunity to know about customers and to improve production processes.

		deal, seen as doorway to largest consumer market. Chu promised of investment. - Facilitated by hard work and commitment of individuals; Jang's prior experience of large volume production of motors; Upgrading of supplier processes; importance accorded to production people, and supportive organization system				Probability of breakthroughs enhanced Doorway to markets
1981-82 June 1983 Dec 1983 1993-94	- Environment change: Deep price cuts planned by big producers. Launch of low cost ovens by Japanese manufacturers. - Supportive environment: GE scouting for supplier to outsource ovens. Stemmed from the realization to reduce costs further. GE's attempt to reduce costs failed. Decision to outsource but quality concerns remain. Support from GE quality engineers. -	- Aspiration: Management not contended with this performance and aspiring for more. - Investments in installing more assembly lines, building, R&D lab and other infrastructure. Investment to automate assembly line operations - European market identified for Push Growing at 20%, Formation of team headed by Kim, Study of market. Information passed on to design section, Oven design developed for European market, Supplies to European market: six countries	Production increased to 1 lac/yr in 1981 and to 2 lac/yr in 1982 Acquisition of magnetron tube facility Small trial order from GE Production reached 7,50,000/yr Idea to seek new markets	**Springboard Breakthrough** Search for entry breakthrough	Repeat order from GE. More orders from GE	

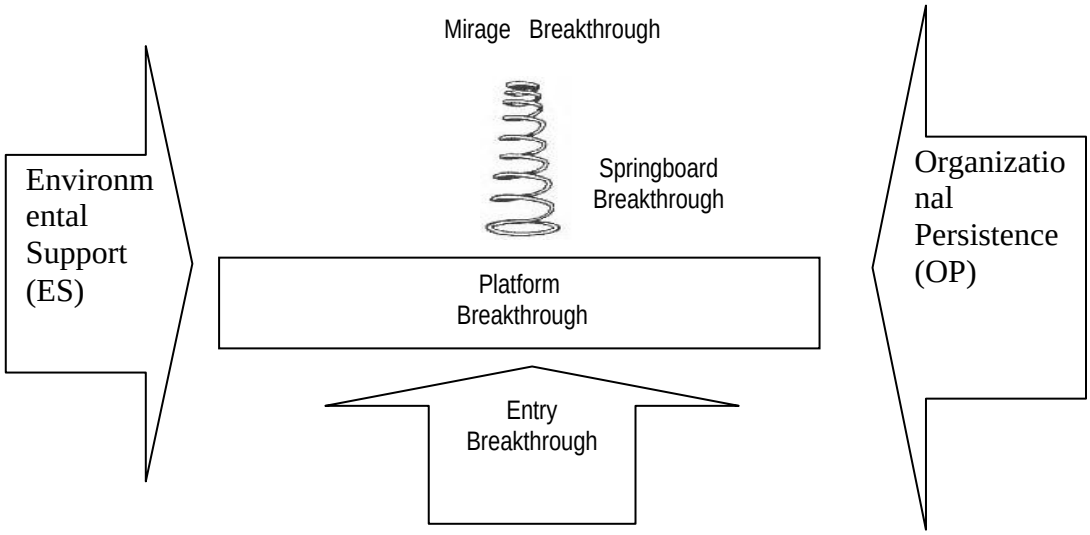
Table 2: Samsung's initiatives for developing DRAM breakthrough capability

Antecedent Environmental Support	Antecedent Organizational Persistence/ support	Breakthrough(s)	Category	Consequent Environmental Support	Consequent Organizational Support / persistence
- Acquisition of Korea Semiconductor Company manufacturing wafers - Availability of cheap labour. Therefore reliance on labour-intensive assembly lines - Import of advanced products from abroad	- Acquisition driven by (a) Intention of moving into a high tech business (b) Anticipation of high growth in semi-conductor business - Ambition to create a global powerhouse for semiconductor and consumer electronics business	Success in producing first semiconductor (watch chip) used in wristwatches	**Entry Breakthrough**	- Recognition from government. - Recognition by President of South Korea for watch chip	- Samsung Electronics made star affiliate and allocation of most of the group's resources
- US educated Koreans willing to be part of this endeavour - Technology available in market - Surplus cash from other businesses to buy imported technology	- Goal to make 64 K DRAMs when no competence was there - Global R&D labs when Samsung was new entrant	- DRAM Technology licensed from US-based company - Formation of set up competing product development teams - Development of 256 & 1 Mbit DRAM	**Platform Breakthrough**	- No visible support	- Learning - Platform built for takeoff - Knowledge creation procedures - Development of dynamic capability
-	- Problem solving capabilities of leadership - Risk taking ability of organization - Irreversible investments	- Adoption of stacking process of manufacturing	**Springboard Breakthrough**	- Samsung recognized as a serious competitor in chip business	- Strong and better cognitive processes of problem solving - Samsung joined industry's top echelon - Higher aspiration (re-ignites learning). Samsung's aspiration to attain leadership position
-	- Huge investment of $1 billion in unproven, first of its kind, in house developed technology (8-inch mass production) - Confidence from past success (willingness to take risk	- Development of pioneering 8-inch mass production technology	**Mirage Breakthrough**	-	- Distinctive competence: Samsung gained number one market share in DRAM industry in 1992 and since then has maintained leadership position

6. Model to Develop Capability to Create Breakthroughs

In the preceding section, we tracked Samsung's initiatives in building technological capability for its memory and microwave oven business. Our focus was on identifying antecedents and consequences for events which we perceived as breakthroughs. When we examined the whole process, we could see commonalities in characteristics of the key events across two cases. We grouped key events into groups which shared similarities of antecedents, consequences, process and impact. Finally, four distinct categories emerged which we have named as Entry breakthrough, Platform breakthrough, Springboard breakthrough and Mirage breakthrough. We now explain each type of breakthrough in detail

Model of building breakthrough capability



Breakthrough Type	Description of Breakthrough	Antecedent		Consequent	
		ES	OP	ES	OP
Entry Breakthrough	Making an important or notable discovery	- Prior experience - Endowments: human capital, locational advantages	- Search processes - Anticipation - Support from top management	- Recognition & promotion from important external stake holders	- Marks entry into a new domain - Experimentation learning - Enhanced management attention and resource allocations
Platform Breakthrough	Penetration of a barrier with consistent achievements	- Availability of surplus resources,	- establishment of processes (including learning) and systems - Activity focused investments towards building resources and complementary capabilities	- Recognition and support from environment	- increase in scale - builds platform for future advancement (combinative capabilities) - probability of sudden breakthroughs enhanced
Springboard Breakthrough	Sudden advance especially in knowledge or technique	-	- Problem solving capabilities - Increased Risk propensity - Aspiration - Huge irreversible investments to build top of the line resources	- Demand from environment	- Sudden and radical jump in firm's position - Base for exploitation of capability - Huge revenue enhancements
Mirage Breakthrough	Creation of an image which is always ahead of its followers	- In-house expertise	- Satisficing	-	- Builds distinctive competence

7. Discussion and Implications

7.1 Entry Breakthrough

We define entry breakthrough as culmination of a process at the end of which firm makes an important or notable discovery. Search processes, related prior experience, endowments, management support and management anticipation are some important antecedents which are indicative of organizational persistence and environmental support. They are the important determinants that enhance the possibility of occurrence of 'entry breakthrough'. Search processes provide information about the environment to the firm. The decision to convert idea to action is supported by related prior experience, endowments, and firm's anticipation about the future. In microwave oven case, environment support to Samsung came in the form of US educated technically qualified Korean people. They provided the much needed technical knowledge and the confidence to take the first big push. Samsung's management also drew confidence from the fact that with its advantage of lower labour cost, it will be able to compete at a global level. Since market demand was anticipated to high in US market, the company was bullish that the environment would be munificent later. Since, the returns are not immediate and the initiative is new to the organization, it needed constant management support. We call successful completion of this phase as entry breakthrough. Once success is registered, firm receives recognition and support from that part of environment whose stakes are similar to that of firm. Initial success also ensures that the business activity is provided enhanced resource support.

7.2 Platform Breakthrough

We define platform breakthrough as culmination of a process at the end of which firm reaches a position or achieves something which makes environment to take notice of

the firm and its activity. In the process, firm breaks a barrier whether mental or market and acquires position of status in the market. This process is facilitated by huge activity based investments and system development. In microwave oven case, Samsung invested heavily to build assembly lines and involved vendors in the development process. Similarly, for memory, competing product development teams were formed resulting in development of 4 Mbit DRAM. Once firm occupies this position, it not only gets recognition from the environment (environment support), it also develops scale and complementary capabilities. The development of resources and complementary capabilities (marketing in case of microwave oven, knowledge creation in case of memory) enhances probability of sudden advancements in capability development.

7.3 Springboard Breakthrough

We define Springboard breakthrough as events which suddenly and radically enhance firm's capability. This requires taking risk which may reflect firm's problem solving capability or just gamble (Organizational persistence). In DRAM case, adoption of stacking technology for chip manufacturing and in oven case, GE's order represents such events. In both cases, environment was deficient in terms of technological uncertainty in former case and market uncertainty in latter case. Springboard breakthroughs result in windfall gains for the firm.

7.4 Mirage Breakthrough

We define mirage breakthrough as events which firmly entrench firm in a position wherein the position acquires becomes a mirage for the followers as well as the leader. It is a mirage for follower, as it keeps on moving away as they try to bridge the

gap and it is a mirage for the leader as that position would always be challenged (followed) by the followers. However this to happen, trigger for learning has to occur otherwise due to satisficing (Winter, 2000) firm may stop learning. A firm acquires such position when it develops some distinctive competence as Samsung achieved for its DRAM business by developing 8-inch wafer technology

8. Future research

Samsung's example shows that 'organizational persistence' and 'environmental Support' are two important determinants of breakthroughs. Changes in nature of these two constructs lead to changes in nature of breakthroughs a company achieves over a period of time. The process of creating a series of different breakthrough explains the process of capability building by firms in the context of high technology. The process is supported by an interaction of internal factors (organizational persistence) and external factors (environmental support). We believe that this conceptualization of capability building process would help managers to anchor their capability building efforts around specific events and initiatives. However, the paper being conceptual in nature, further exploration of this construct would require developing measures for organizational persistence, environmental support, and for each type of breakthroughs and test them against the desired or serendipitous outcomes. While we have described the determinants, consequents, and the typology of breakthroughs which help and guide capability building process, these could be highly context specific and more studies are required in different context to further develop this typology.

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