

## **Technology Strategies for Global Competitiveness: Next Practices from India's Leading Companies**

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The objective of this paper is to document the “next practices” followed by Indian companies in the area of Technology Strategy as they seek to improve their competitive position in global markets. The paper starts with the underlying conceptual framework, and then identifies seven “next practices” based on specific company data. The paper ends with identification of some of the common characteristics of the companies formulating these practices, and the future challenges faced by them.

### **Conceptual Framework**

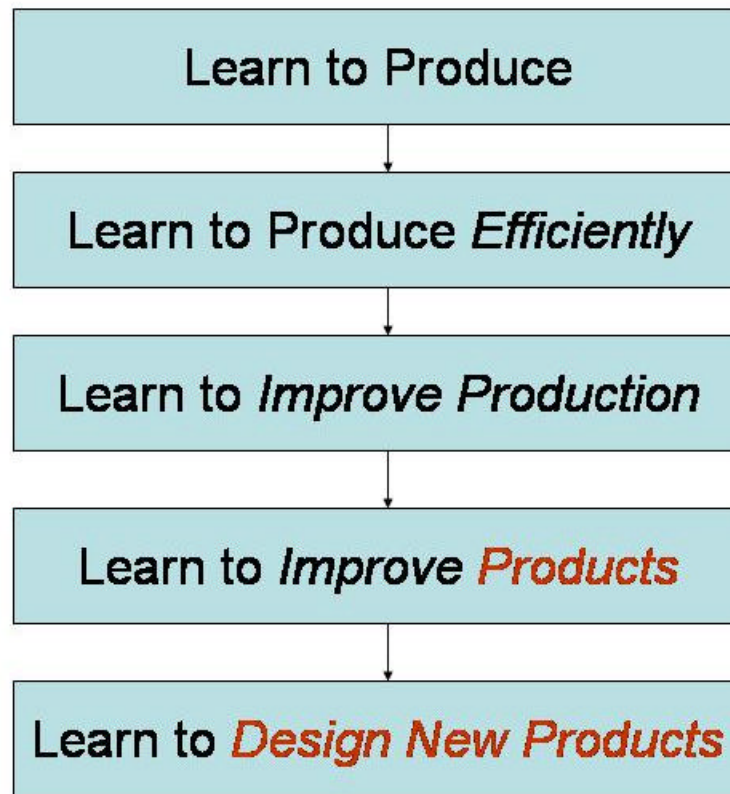
An important driver, perhaps even the most important, of the economic development of nations is the acquisition of technological capabilities. Modern industry is driven by technology, and lack of access to technology can stunt economic growth. In all the cases of rapid economic growth observed in the late twentieth century – Korea, Taiwan, and Singapore - technology played an important role.

Acquisition of technological capabilities can be understood as a learning process.<sup>1</sup> To start with, firms need a production capability – the ability to run a plant that produces a particular product. The process of acquiring a production capability is initiated by importing a plant from another country or having a new plant built by an engineering contractor to the specifications provided by a technology provider. Through training and “learning by doing”, the firm learns how to operate the plant, and gradually improve the yield from it. In the second stage, firms develop an investment capability – the ability to create a new plant of a chosen capacity and specifications. Finally, firms develop an innovation capability – the ability to create new products, and the manufacturing infrastructure to produce these products. These three stages can be viewed as understanding the “know-how”, “know-why” and “create new” of the particular product category.

This simple framework has been expanded to a 5-stage model that further elaborates the steps (see Figure 1).<sup>2</sup> The first stage is to “learn to produce”. But production by itself is not enough. To be competitive the manufacturer needs to be able to produce efficiently, at least on par with others operating similar plants. The second stage is therefore “learn to produce efficiently” – this stage involves subtle, tacit knowledge, learnt essentially by doing, that may not have been part of the technology transfer agreement covering the initial acquisition of technology. In the third stage, firms move away from following the process as originally prescribed – they make their own changes to the plant design and processes, i.e., they “learn to improve production.” This stage could include de-

bottlenecking, process improvements and process re-engineering. Once the process skills are mastered to a degree, attention is shifted to the products being manufactured. Stage 4 is to “learn to improve products” through incremental modifications often through value engineering, material changes, and product enhancements. Finally, firms “learn to design new products”, i.e. they develop the capability to innovate.

These stage models describe quite well the process by which firms in developing countries in industries as diverse as steel, fertilizers, electrical equipments, and petrochemicals have developed the technological capabilities to compete in domestic and global markets.



Source:  
Forbes & Wield,  
2002

**Figure 1: The Technology Capability Hierarchy**

### **Technology Management in India**

The technology management challenges faced by Indian firms in the past were closely related to the first three stages of this technological capability-building process. The absorption and improvement of imported process technologies was the biggest challenge faced by Indian companies. Indian firms took decades to be able to catch up with global productivity levels. In the import substitution regime, particular emphasis was placed on using locally available raw materials and intermediates. This often implied changes in the production processes from the originally sourced process. For example, Indian coals have high ash content, so Indian steel plants had to learn how to modify their steel-making

process to use local coal yet not compromise the quality and yield of the end product. Similarly, Indian crude has high sulphur content, so refining processes had to be developed and improved to deal with this characteristic. In the pharmaceutical industry, the Indian patent regime allowed Indian companies to produce drugs covered by product patents elsewhere as long as they could come up with a process that did not infringe the process patent(s) of the original innovator. This spurred Indian pharmaceutical capabilities to develop sophisticated process capabilities.

An alternate source of technology for firms was the wide network of government research laboratories. Here the challenges were of a different nature. The technologies were often demonstrated at the laboratory-scale but both the laboratory and industry lacked the funds to scale-up the technology. Design and engineering capabilities in the laboratories were weak, and this impeded the scaling-up process. The transfer of technology from laboratory to the firm thus became a serious management challenge.

Post-liberalisation, Indian firms have been under tremendous pressure to improve their competitiveness. The removal of physical restrictions on imports and the lowering of customs duties implied that Indian firms had to be as good (or nearly as good) as their international competitors in order to survive. This accelerated the process of technological absorption. Several companies also pushed ahead in improving production and improving their products so as to be able to add value to their products and improve profitability.

More recently, in the last decade, the emphasis has been shifting to innovation and product development. Several industries, particularly the automobile, two-wheeler, and pharmaceutical industries have seen a high level of product innovation activity.<sup>3</sup>

This focus on innovation poses new challenges for Indian companies. Innovation is less predictable, and more risky than the earlier stages of capability-building. Indian companies lack experience in managing innovation and there are no easy recipes to follow. Intellectual Property Rights (IPRs) play an important role in protecting innovations from being copied by others and companies now have to formulate IPR strategies that complement their competitive strategies.

### **Next Practices of Leading Indian Companies**

Against this backdrop, leading Indian companies are devising new technology strategies to drive technology-led innovation. Prominent among these practices are:

- Structured Market-driven Product Development Processes
- Use of Advanced Product Development Tools
- Acquisition of new technologies through acquisition of foreign companies
- Acquisition of foreign companies for their Intellectual Property
- Acquisition of foreign companies for new formats and standards
- Combining technological innovation with legal innovation

- Innovation across the value chain leading to affordable products that can grow the market

### ***Structured Market-driven Product Development Processes***

The product development literature has emphasized the importance of structured product development processes for many years now.<sup>4</sup> However, the use of structured product development processes is a relatively recent phenomenon in Indian companies. The development of the light commercial vehicle *Ace* by Tata Motors<sup>5</sup> is a good example of how the use of structured product development processes and other product development best practices improves the probability of product success.

In the development of the *Ace*, the first important step was the identification of a sizeable opportunity. With increasing traffic congestion and curbs on the movement of heavy vehicles in India's cities, the company realized the need for a safe and comfortable "last-mile" vehicle to transfer goods. The product concept, while addressing this opportunity, also provided for differentiation and meeting the upwardly mobile aspirations of the country. The company decided to create a 4-wheel vehicle as against the commonly used three-wheelers that currently service this application because market feedback suggested that a four-wheeler would enhance the status of the owner. Aesthetics of the vehicle was stressed upon to reinforce this boost to status. At the same time to be competitive, the vehicle could not afford to be much more expensive than 3-wheelers.

The Marketing department was involved right from the beginning of the product development process. The identification of user needs was a market-driven process involving interviews with 600 drivers, owners, end-users, mechanics and opinion-makers over six months. User needs were captured in customer use statements. These customer use statements were translated into specifications rather than starting with technical specifications. Customer inputs were taken at subsequent stages of the product development process as well. Yet, throughout the process the key design objectives such as cost per tonne per kilometer were emphasized to ensure that the product would have a good acceptability in the market.

Realising that the creation of a vehicle like the *Ace* would need fresh thinking and a break from past practices, Tata Motors deliberately created a young team with good leadership capabilities who networked well within the company to undertake this project. Their passion and new ways of thinking were expected to facilitate the exploration of new concept ideas.

The Tata Motors team realized that product innovation needs to be complemented with innovation in other parts of the value chain for the product to be successful. Several new approaches such as co-location of suppliers, on-line bidding by suppliers, reduction in the number of suppliers, partnerships with vendors, and a dedicated "Suvidha" service network in small towns were followed.

The *Ace* project had impressive results. 30,000 units were sold within 8 months of launch. Buoyed by the demand, Tata Motors decided to set up a new factory to product the *Ace*. The *Ace* also created the possibility of developing a competitor to Maruti's popular Omni van. The *Ace* enhanced organizational dynamism, and provided the impetus for Tata Motors' ambitious new small car project.

### ***Use of Advanced Product Development Tools***

Sophisticated tools based on advanced information technology offer companies the ability to manage complex processes more effectively. Product Lifecycle Management (PLM) tools enable companies to enhance repeatability (leverage intellectual property assets; enforce standardized, repeatable work methods), ascend steeper learning curves (by accessing the right information), and synchronize development through concurrent work efforts on different components.<sup>6</sup>

Crompton Greaves' transformer division has adopted PLM in an effort to hasten pre-sales activities, cut down time taken on short-notice jobs that require quick response, and achieve faster product commercialization.<sup>7</sup> The company achieved a reduction of 40% in the presales enquiry to order time and a reduction of 30% in design cycle time. The company has reported substantial cost savings as a result.

### ***Acquisition of New Technologies through Acquisition of Companies***

Technological capabilities are more than designs and drawings, or plant and machinery. They are embedded in the organizational practices of the organization. It is therefore no surprise that technology transfer is a challenging process. The transferee company often misses out on the organizational practices and culture that go along with continuously improving the technology. Acquiring entire companies for their technology helps overcome this problem. But the acquisition of companies, particularly the integration of the acquired company, is no trivial task and several studies have shown that a majority of acquisitions fail to enhance shareholder value.

In January 2004, one of India's leading automobile component manufacturers, Bharat Forge Ltd., acquired Carl Dan Peddinghaus GmbH & Co. (CDP) in Germany.<sup>8</sup> Founded in 1839, CDP is renowned for its product design and development capabilities. It has historically worked very closely with BMW and other German automobile companies to develop suspension components for their new vehicles. Through the acquisition of CDP, Bharat Forge got access to the superior design capabilities of CDP and also the opportunity to work closely with BMW. This will enable Bharat Forge to get sole supplier contracts for components developed for new BMW vehicles. Subsequently, Bharat Forge acquired CDP-Aluminiumtechnik, a major supplier of aluminium forgings to BMW, Audi, and Volkswagen, thus enabling it to move into the growing area of aluminium forgings.

### ***Acquisition of Foreign Companies for their Intellectual Property***

As companies develop new technologies, they face the challenge of protecting these technologies from copying and imitation by others. Various forms of intellectual property protection – patents, trademarks, copyrights, design registrations – are used to achieve this purpose. However, this is not the only way in which intellectual property has to be aligned with technology strategy. Companies working on new technologies also have to ensure that their technologies are not infringing patents already obtained by others, or that the patents that they obtain on their technologies are not challenged later by others citing prior art or obviousness. Technology companies therefore sometimes acquire the patents of other companies or the companies themselves as a defence against future holdup.<sup>9</sup>

India's leading biotechnology company, Biocon, is working on human oral insulin drugs.<sup>10</sup> The advantage of oral insulin drugs is that they mimic the way the human body uses insulin to control glucose and are therefore potentially more effective. In early 2006, Biocon acquired Norbex, a US-based company that had developed a first generation human oral insulin drug, HIM2, and licensed it to Glaxo Smithkline (GSK). Biocon acquired Norbex even though HIM2 was finally never commercialized because the acquisition of Norbex gave it access to more than 300 patents/patent applications related to oral insulin. These would help Biocon in mounting both defensive and offensive strategies in the field of human oral insulin drugs, and thereby enhance the chances of success of its own second-generation human oral insulin drug under development.

In early May 2007, an Indian pharmaceutical company, Wockhardt, acquired Negma Laboratories, the 4th largest independent pharma company in France with sales of \$150 million.<sup>11</sup> Negma is a research-based pharmaceutical company with 172 patents with a focus on the areas of osteoarthritis, rheumatology, and arterial hypertension. Wockhardt's aim is to extend the patent portfolio of Negma to other European markets where Wockhardt has a strong presence. Europe now accounts for 60% of Wockhardt's revenues

### ***Acquisition of foreign companies for new formats and standards***

In network industries, companies compete on formats and standards in addition to products. The legendary story of the videocassette format wars between Sony's betamax on the one hand and the VHS format promoted by Philips, Panasonic and others on the other has underlined the importance of getting wider acceptability of a particular standard or format. Content producers will make their content available only in the format which seems poised to win the battle to become the de facto standard in the industry. Format wars involve high stakes, the need to form powerful alliances, and a clear understanding of which user needs will drive purchase behaviour.

Moser Baer was already a prominent player in the global recordable optical media market with a market share of 16.5% when, in early 2007, it decided to acquire OM&T BV, a subsidiary of Philips NV.<sup>12</sup> OM&T BV is a pioneer in the Blu-Ray technology, one of the competing formats in the DVD standards race. OM&T was involved in significant development and commercialization activities in the Blu-Ray space. At the time of the acquisition, OM&T was the only company outside Japan manufacturing and shipping

Blu-Ray discs. Through the acquisition of OM&T, Moser Baer hoped to enhance its position in the next round of the optical format race. This strategy has apparently paid off – in May 2007, Moser Baer announced that it was the first company in the world to develop the next generation Blu-Ray disc.<sup>13</sup>

### ***Combining technological innovation with legal innovation***

In the pharmaceutical industry, Indian companies have traditionally competed on cost. They used their superior process skills to develop alternate processes for existing drugs that enabled them to produce the drugs at a fraction of the cost. They developed international business in those markets where the product patents of the innovator did not hold.

In the 1990s, Indian pharmaceutical companies made an effort to enter developed, patent-protected markets, including the United States, the world's largest pharmaceutical market. Since they did not have patent-protected molecules in their portfolio, the obvious point of entry was the generics market. To bring down the costs of health care, the United States has policies in place to encourage generic drug producers. One of these is Para IV of the Hatchman-Wax Act that provides 180 days marketing exclusivity to the first generic producer who proves that he either does not infringe the patent of the innovator, or is able to establish invalidity of the innovator's patent. Obtaining such 180-day exclusivity is a potential goldmine for generics producers compared to competing with other generic producers in a crowded market for off-patent drugs.

The quest for 180-day exclusivity has compelled Indian pharmaceutical companies to combine technological and legal innovation.<sup>14</sup> Ranbaxy saw the challenge as: "How can you develop pharmaceutical products in the face of patents, government laws and regulations, and court decisions that limit your options; the mandate being a product approved and on the market by a particular date." The solution they came up with was to "make legal and scientific innovation a necessity, rely on it regularly, and set up an organization that permits such reliance."

Ranbaxy has thirty-plus technical specialists in different time zones working together in a mutually dependent relationship. Their tasks include the preparation and prosecution of patent applications, preparation and clearance of product formulations, analysis and development of patent noninfringement and invalidity positions, support for worldwide patent litigation efforts, search for new product opportunities, monitoring competitors' litigations, evaluation of IP aspects of business deals, and operating in the area between patent law and FDA regulatory law.

### ***Innovation across the value chain leading to affordable products that can grow the market***

The Indian market has a large number of consumers with limited purchasing power but the aspiration to participate in the growth of the economy. Products designed to meet their unique needs have large demand in volume terms but need to be priced very

aggressively. They also need to be packaged in shapes and sizes that suit the consumption and spending patterns of the consumers.

Meeting these needs involves innovation across the value chain. All six levers of innovation – the value proposition, supply chain, target customer, product/service, process technologies and enabling technologies – need to be addressed.

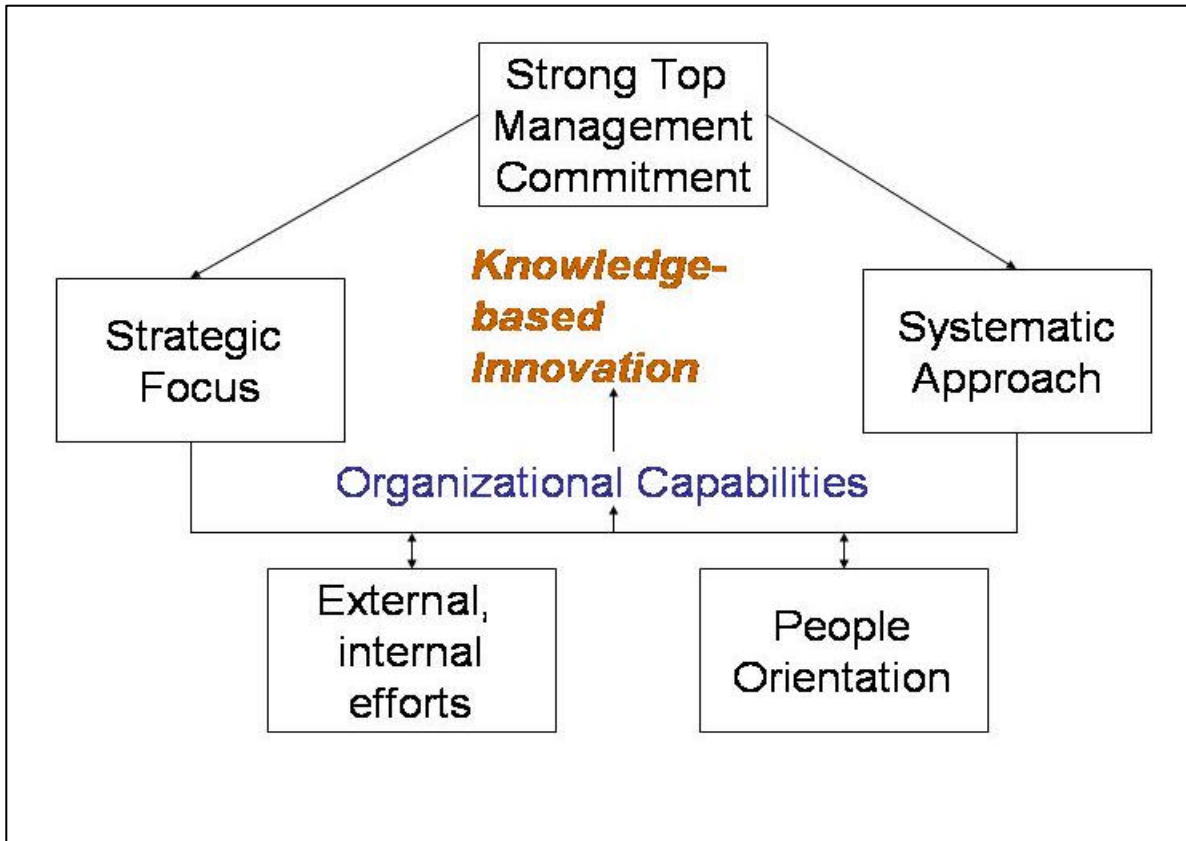
The Indian mobile services market is the fastest growing in the world. This growth has been enabled by companies such as Bharti Airtel and Reliance Communications that have used multiple levers of innovation effectively. The lifetime prepaid service that offers consumers mobile access for incoming calls “for life” (actually for the duration of the service provider’s licence) at a price of Rs. 999 (recently reduced to Rs. 495) payable in installments offered a unique value proposition of life-long, low-cost telecommunication services to a target customer who would never dreamt of owning a mobile phone. Offering such a service has been possible through the use of a strong information technology backbone which, in the case of Bharti Airtel, is outsourced to a prominent multinational services provider (IBM).

### **Characteristics of Indian Companies Spearheading Next Practices<sup>15</sup>**

Given the resources and attention required to build technological capabilities, Indian companies at the forefront of technology management next practices have a sharp strategic focus. The top management is strongly involved in, and committed to, internal efforts in developing new products and technologies; often, the top management has a strong technical background such as Baba Kalyani at Bharat Forge or Parvinder Singh at Ranbaxy. These companies believe in learning by doing, support multiple initiatives, are open to external inputs and collaborate with others when necessary. However, all these efforts are coordinated internally. These companies prefer to use independent consultants who are less expensive and more likely to share tacit knowledge with people in the company. They share a systematic and step-by-step approach to capability development. Realizing that the success of this is largely dependent on people, they have built a loyal cadre of committed employees by giving them challenging tasks, good facilities, competitive remuneration and, importantly, fair and transparent treatment. The approach followed by these companies is shown in Figure 2.

### **Future Challenges**

Indian companies at the forefront of technological innovation face several challenges. The chief challenge is increasing complexity. On the one hand they have to continue to generate cash from their existing businesses to be able to finance their innovation strategies – this implies a strong operational focus with emphasis on productivity and efficiency. On the other hand, they have to build advanced innovation capabilities. The organizational requirements of these approaches can be quite different and reconciling this diversity within a single organization is a major challenge.<sup>16</sup>



**Figure 2: Technological Capability-building Approach**

Another dimension of complexity is managing across different regulatory regimes and different cultures. Several developed markets, particularly the United States, have stringent product liability laws, and a single product liability award against a company could threaten its net worth.

External threats exist as well. Reaction from incumbents is likely to be more sharp in the future. In the pharmaceutical industry, the giant innovation-based pharmaceutical companies are devising new strategies to challenge the entry of generics players. These include setting up generics subsidiaries, licensing their products to other companies near the end of the patent life cycle, and using pricing strategies to deter entry by generics producers.

So far, Indian companies have benefited from a growth momentum and a favourable economic cycle. Their ability to sustain technological capability-building in a downturn remains untested. The depth of the top management commitment will be revealed when the next (inevitable) downturn happens.

The availability of high quality human resources in the numbers needed is going to be another challenge. The number of doctorates from Indian institutions of higher learning is stagnant, and Indian higher education at the undergraduate level is focusing on quantity rather than quality.

## Notes and References

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