Technology Development in Developing Countries

Global Business, Technology and Knowledge Sharing: Lessons for Developing Country Enterprises, *by N S Siddharthan and Y S Rajan; Macmillan, New Delhi, 2002; pp 217, Rs 285.*

RISHIKESHA T KRISHNAN

The core argument of the authors is that while technology has become critical for competitiveness, the environment in which developing country enterprises create and use technology has become much more complex and dynamic thanks to greater integration with the world economy, the 'global' strategies of multinational enterprises, changes in the rules of the game such as the World Trade Organisation (WTO) agreements, and the fast pace of technological change. To cope with this challenge, the ability to monitor, assess and forecast technology trends, build internal technological capabilities, enter into alliances, and be a part of multiple networks is important for these enterprises. Government's role is to facilitate firms to undertake these activities as has been done by India's Technology, Information, Forecasting and Assessment Council (TIFAC) through the provision of (1) generic sectorwide technological forecasting and assessment reports at a nominal cost, and (2) financial and networking support for small and medium enterprises through the Home Grown Technologies (HGT) support scheme.

Starting with an overview of the global business environment, technology and economic development, the authors look at foreign direct investment and its impact on technology development; technology imports and in-house research and development (R and D); technology acquisition and growth of firms; technology and exports; and technology intermediation. The authors make several important points. The ability of a country or an enterprise to purchase technology depends on its own R and D and technology base (p 23). Domestic R and D and import of technology need to go together (p 48). The process of technology creation and assimilation into business is not a linear process (p 119). Policy for government and firms has to change with time and context – what worked for other countries and companies in the past may not work for Indian companies today (pp 120-121). Business and technology are dynamic and though it is difficult for a new entrant from a developing country to enter global markets, there are sometimes short-lived windows of opportunity (p 122). Exploiting these opportunities depends on being part of a network of universities, academic institutions, research laboratories and firms. The dynamic of technology is not only multi-institutional, but also multi-disciplinary (p 125). There cannot be a uniform national strategy across sectors (p 122). Firms have a central role in international trade in goods and technology and there is a need for creating institutions that can play the role of technology intermediation (p 188). Even the WTO does allow certain types of government support for R and D and technology development though we have not chosen to leverage this flexibility optimally (p 195). Government's role goes beyond technology intermediation to providing the right climate for industrial development – control corruption, make customs clearance more efficient, improve condition of roads, speed up judicial process, reform power sector, improve infrastructure (pp 192-197).

Given the major changes that have taken place in the last decade, this book is a timely addition to the literature on technology development in developing economies. The reviews of existing literature, particularly literature relating to the relationship of technology development to FDI and exports, would be useful to the student and the policy-maker. This book will be of interest to policy-makers and administrators as it explains in some detail the need for technology intermediation and, based on the TIFAC experience, the role governments can play in enhancing technology intermediation. The case studies of firms that have taken financial support under the HGT scheme and the table listing the projects approved so far provide a welcome degree of transparency about the scheme. However, the sub-title of the book notwithstanding, this book is of limited utility to a person running an industrial enterprise. While the book does underline the importance of technology to the modern enterprise, and through the case studies gives examples of companies that have persevered to build new technologies in India, the authors do not give a clear picture of what the enterprise needs to do to develop the necessary technological capabilities to be competitive. It is difficult to draw lessons from the case studies because they lack adequate detail. Where the authors themselves attempt to draw lessons, they are too general to be of much practical use.

This gap can be filled only if one takes a more explicitly managerial perspective. Technology should not be viewed as an end in itself but as a means to achieving business success. The authors do recognise the importance of the entrepreneur but they tend to overemphasise the importance of technology and underemphasise the importance of other business factors. There is an implicit assumption that if firms get their technology development right, everything else will be taken care of automatically. For example, they state that, "Indian entrepreneurs who are able to exploit technological opportunities and introduce new products will succeed in global competition. Industrialists who are not technologically oriented will fail" (p 95). However, the most significant industrial success story of India since independence, the Indian software industry, is clear evidence of the limitations of focusing on technology alone. Companies or entrepreneurs who focused on technology to the exclusion of other organisational and business factors have failed while those who succeeded have taken a holistic business perspective. While it can be argued that the long-term competitiveness of the Indian software industry may be well-served by having a more diversified set of firms, some of which develop new technologies and products rather than by all firms adopting the successful service model, the integration of technology and

business and using this to drive business and economic success is a very challenging task. In some of my ongoing research with Indian software companies who are trying to develop new software-based products and components for telecommunication vendors, entrepreneurs have estimated that creating the technology is only 15-20 per cent of the overall challenge and possibly the easiest part. Understanding market trends, and ultimately selling the product or technology, and obtaining venture capital to stay afloat till such time that revenues get established are the bigger challenges faced by these companies. Integrating R and D and business (of which technology forecasting and assessment forms one dimension) is perhaps one of the biggest challenges faced by small and large companies alike [Ganguly 1999].

Another question not explicitly raised by the authors but an important one for technology-intensive ventures to achieve business success is: What should be the appropriate technology strategy for Indian firms? Should they be trying to develop cutting edge technologies on par with the best in the world? Or should they be trying to develop technologies that are 'appropriate' for competing in the local market? In the long run of course a mix of technology and product development projects of differing levels of novelty, complexity and risk would make most sense [Wheelwright and Clark 1992]. But for the short-to-medium term an effective technology strategy may be to operate within the technological frontier while pushing the design frontier based on intuitive understanding of user needs, strong design capabilities, and integration with manufacturing (Forbes and Wield 2000].

The authors hold out the success of South Korean firms as a valuable example of how companies from emerging markets can become global players through the building of technological capabilities. While it is true that South Korean chaebol such as Samsung, LG and Hyundai have successfully traversed the path from "imitation to innovation" [Kim 1997], it is important to note the policy framework within which this capability-building happened. The chaebol got low-cost financial assistance and protection from imports, and were supported to grow into large oligopolies; in return the state required them to export, and to develop internal technical strengths [Amsden 2001]. But this model was feasible in a certain geo-political era; the present strength of Korean companies is a path-dependent outcome that cannot be replicated by other countries today. Another issue raised by the Korean example is the question of scale. Though the authors assert that thanks to a number of technological developments, being small is no longer a disadvantage (p 108) and in fact may enable firms to be more agile and responsive to customer requirements, most developing country success stories show that a minimum scale is required to be able to make the minimum investments required for technology development and taking products to the market. The Indian experience in the pharmaceutical (Ranbaxy and Dr Reddy's Laboratories), two-wheeler (TVS Motor and Bajaj Auto), and power equipment (BHEL) industries suggests that a turnover of the order of Rs 1,000 crore (approximately $200m) is the minimum level at which firms can afford to make significant R and D investments and provide the required marketing support to effectively commercialise new products.

What Can India Do?

If the Korean model is not feasible, what can a country like India do? Setting existing family-owned firms on the path of growth and technological upgradation may be a difficult task because becoming more technology-focused also means the entrepreneur giving up a degree of control unless he has a background, interest and competence in technology-related issues. Greater technological sophistication is thus closely linked to greater professionalisation of the enterprise and this is likely to be a slow process. Prolonged inaction on the small and medium enterprise (SME) front has now made survival the principal challenge for SMEs and it is difficult to visualise existing SMEs getting on the fast track. In this context, the authors make the important point that China has been successful in attracting FDI to modernise the technology of the SME sector whereas through continued reservation and limits on foreign equity, we have deprived Indian SMEs of the benefits of better technology (pp 65-66).

It therefore appears that a technological renaissance in India cannot happen without a new generation of technology and business-savvy entrepreneurs. An important point that the authors do not mention is that we need to provide a conducive climate for the creation of new firms whose owner-technologists are already part of technological (if not business) networks. This is the approach pursued successfully by Taiwan through efforts to attract their technologically-qualified citizens residing overseas to invest in creating high technology ventures in Taiwan. The primary vehicle for this has been the creation of science parks through which new enterprises set up by overseas Taiwanese get access to world-class infrastructural facilities (including residential and schooling arrangements) and seed funding to cover start-up expenses. By virtue of the links of their founders, these enterprises are automatically part of an international network from day 1 and become part of the Taiwanese manufacturing cluster over time. This idea has been subsequently adopted by China as well. In addition, China has created strong support and incentives for the creation of science-based enterprises. Recognising that transferring new and unproven technology from a government laboratory to an enterprise will always remain problematic, China has established schemes to encourage groups of scientists to move out of the laboratory and found new enterprises. China's largest computer maker, Legend, is the outcome of one such move outside the boundaries of the laboratory. In India itself, one of our most successful companies, Punjab Tractors, was formed in a similar way decades ago but it appears that we have been unable to create a systematic way of replicating this experience. Just as successful venture capitalists try to put ideas and people together to create new ventures when the need arises, a more proactive approach to technology-based venture formation will be needed if we are to build on existing networks rather than trying to create new ones.

Even today, government policy can play an important role in technology development in other ways as well. It is no accident that the two-wheeler industry has been one of the most innovative parts of Indian industry. It was one of the first industries to undergo deregulation and is perhaps one of the most competitive industries in India today. Regulatory changes that necessitated compliance with stringent emission norms have pushed two-wheeler manufacturers to develop engine technologies that comply with emission norms. The need for product differentiation, without incurring the large design and technology royalty costs sought by foreign collaborators, has induced the creation of local design capabilities. Individual aspirations for personal mobility (cleverly encouraged by the manufacturers) have ensured a steady growth in demand for two-wheelers to more than 4 million vehicles per year – this ensures that the large players such as Hero Honda, Bajaj and TVS have the volumes required to be competitive players. Anticipated regulatory changes have similarly influenced technology and product development in the pharmaceutical industry.

Companies are thus more likely to become competitive when the national environment supports the creation of specialised skills and assets [Porter 1990]. By enhancing standards to international levels, the government can facilitate this process.

While this book provides a useful overview and asks many relevant questions, the reader would have certainly benefited from a greater degree of specific detail in some of the discussions. For instance, right in the first chapter, a section titled 'Strategies of Developed Countries' lists some of the features of the technology support policies of the European Union, the US, Japan and China. The information provided about these is idiosyncratic with some details regarding the US but hardly any of Japan. No effort is made to compare their policies on a common set of dimensions and criteria, nor are any clear implications drawn for developing countries. Some references are made to other sources for details, but many of these are not available to the average reader. No justification is provided for the inclusion of China in this section on developed countries. Again, though the authors assert that we have a mindset problem manifested as an "obsession with coordination" (p 16) and that this is a major reason for the lack of output from the Indian S and T system, little evidence is provided to justify this statement. A discussion of "intra-firm trade" (pp 106-108) fails to make the important point that the lowering of trade barriers and taxes and the spread of low-cost IT and telecom facilities have allowed large enterprises to locate their manufacturing and service facilities of different components and products at optimally located 'centres of excellence' and serve the rest of the world from these limited locations thereby increasing intra-firm trade.

The impact of the ideas of this book is also somewhat attenuated by uneven editing. Some tables and examples don't have sources (e g, Table 2.1 on p 22; Tables 3.1-3.4; injection of capital by Toyota and Honda in their Thai subsidiaries in the wake of the financial crisis on p 27); there are quite a few inconsistent and wrong spellings (e g, "computed temography" instead of computerised tomography on p 47); most references to research studies focus on the findings rather than the methodology, but suddenly you find references to "logistic regression equations" and "negative binomial model" (p 41); and it is difficult to comprehend how LAN, WAN and MIS could be included under the list of integrated manufacturing technologies (p 110).

In spite of these shortcomings, I would recommend this book to students, academics and policy-makers, as a unique partnership between a distinguished economist (Siddharthan) and an experienced technologist-administrator (Rajan) has resulted in a topical and thought-provoking book. EPW

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