

1. Introduction

This book documents the journey embarked on by firms in five different industries over the period of a decade (1993–2003) beginning shortly after the liberalization of the Indian economy in 1991. It includes ‘old economy’ industries such as steel, automotive components, heavy equipment and other manufacturing industries, and ‘new economy’ industries such as software and biotechnology.¹

Internationalization has largely been examined from the perspective of industrialized countries with some exceptions (Dahlman and Westphal, 1982; Westphal, Kim, and Dahlman, 1985; Lall, 1987; Enos and Park, 1988; Chang, 2003; Guillen, 2005) of studies on how developing countries and emerging economies build capabilities. Although problems and issues related to development have been widely studied, the emphasis has been on technology transfer by foreign firms and its attendant difficulties rather than on the innovative capacities of recipient firms. This book aims to redress this balance by adopting an evolutionary approach to capability-building and focusing on innovation in India, a developing country, and to situate this process in the context of a transition to a market-oriented economy. Although the perspectives applied in this book are not new, they have been synthesized and applied in a novel context – an emerging market.

CONTEXT

I draw on a variety of disciplinary perspectives to develop a theoretical framework for the creation of organizational and technological capabilities. It combines perspectives on social learning, internationalization, knowledge and capabilities, real options, and complexity theories to yield a deeper understanding of *how* internationalization occurs. The analysis focuses primarily on firms and industries, while the institutional context and regulatory environment provide the backdrop. I begin with a micro-level examination of the firm as the context for learning and innovation via the adoption of new technologies and knowledge from external sources. Organizational and technological skills are developed by adapting these new technologies for local use. Successful adoption and assimilation of new technology, its diffusion and innovation are dependent on the creation of

communities of practice that encompass inter-firm relationships with foreign suppliers of technology, inter-departmental relationships within the firm and relationships with local suppliers. I examine this process of community creation via an in-depth study of three firms in the steel, construction equipment, and bearings industries located in Eastern India. These case studies are corroborated using supplemental data from seven other firms located in Northern, Western, and Southern India. Findings suggest that internationalization begins with the adoption and replication of technology and associated organizational practices and culminates in an identity shift and aspiration adjustment towards becoming 'world class'.

Despite improvements and capability-building in the manufacturing sector during the initial stages, global oversupply, commoditization, and lack of economies of scale constrained the emergence of Indian firms as important players in global markets. Nevertheless, these early attempts to modernize and globalize initiated a wider dissemination of the methodological approach of scientific discovery and triggered an introspective examination by firms to discover 'core competences' and 'inimitable resources'.² In subsequent stages, Indian manufacturing firms took a more proactive stance in initiating internationalization using an arsenal of techniques acquired as a result of their encounters with foreign firms.

INDIAN SOFTWARE

In contrast, the emergence of a new industry, software, catapulted India onto the global stage. Indian participation in software was not hampered by the regulatory environment, which focused, instead, on computer hardware. While the computer industry was designated a strategic industry, under the regulatory regime of the 1970s and 1980s, it suffered the same regulatory restrictions and requirement of indigenization imposed on other industries. Consequently, the software industry was a peripheral offshoot, largely unregulated in the 1980s with small firms emerging to provide services in the vacuum created by the withdrawal of IBM from India in the mid-1970s (Heeks, 1996).

Moreover, software was an emerging industry worldwide; leading firms like SAP, Microsoft, Sun Microsystems and Oracle were established, starting in 1972. Indian entrepreneurs with technical skills acquired at educational institutions like the Indian Institutes of Technology seized the opportunities created by the emergence of a new industry and the presence of a critical mass of skills available in India. Moreover, Indian entry into foreign markets was facilitated by rising demand for low-cost computer programming. The large pool of programmers available at lower wages

presented a labor cost advantage that Indian firms were able to leverage for their own growth during the 1990s. Advances in technology and experiments with the Internet for commercial use also made it possible for firms in developing economies to participate in cross-border work leading to its reorganization and spatial distribution. Just as manufacturing firms in the industrialized world had earlier sought flexibility through access to manufacturing locations in developing countries, knowledge and technology-intensive firms in the 1990s began to seek low-cost knowledge inputs from developing countries at earlier stages of the technological life cycle to alleviate uncertainty and speed the introduction of new technologies. Consequently, the emergence of knowledge-based industries in the developing world and its trajectory complements its increasing maturity in the industrialized world.

The global success of Indian software also sensitized firms in industrialized countries to the advantages of tapping India's technically skilled workforce in other knowledge-intensive domains such as biotechnology. While government sponsorship of science and technology and incentives to build this industry rendered it attractive for local firms to invest, foreign multinational corporations (MNCs) also began attempts to reduce the cost of innovation while establishing a foothold in new markets. I present evidence from both biotechnology and software firms and outline the evolution of participation in the global economy by both Indian and foreign firms in these industries to contrast with the evolution of manufacturing firms.

RESEARCH QUESTIONS

This book seeks to answer the following questions.: How do firms in developing countries grow and expand across national boundaries and what capabilities enable some firms to outperform others consistently? What organizational processes and practices are effective in enabling participation in innovation and in fostering wealth creation in an emerging economy? What factors are impediments, and what ideological shifts are required for transformation? I do not judge local culture or values. However, I contrast the new ideologies of globalization with earlier cultural assumptions to show how adopting new cultural values sets developing societies on the path of transformation and generates new options.

This book's central thesis is that firms evolve and grow by developing internal capabilities and adapting to changes in the environment. Learning and innovation are the key mechanisms underlying international expansion and occur through interactions with domestic and international firms and national and international institutions.

ORGANIZATION OF THE BOOK

The second chapter outlines theories used in examining firms in both old and new economy industries. It combines evolutionary and knowledge-based approaches to understand the emergence and growth of firms in these industries and study how innovation occurs. Evolution occurs through knowledge replication and the ability to access new knowledge. In the absence of knowledge in the local environment, it must be sought externally. The evolution of new capabilities in domestic firms transforming them into multinationals involves several steps:

1. In the first stage, community creation is critical to enable knowledge transfer.
2. In the second stage, which is transitional, newly acquired capabilities are institutionalized.
3. In the third stage, firms must scale operations, develop complementary capabilities and access new markets and financial resources to gain membership and centrality in the global community of firms.³

However, the environment must be sufficiently diversified to absorb the output of knowledge creation activities. Firm growth is also limited or inhibited by aspiration levels, the level of specialization in the overall economy and the ability of firms to accommodate heightened complexity. Nevertheless, to overcome the limitation of low specialization in the local economy, the community need not be confined locally but can be globally distributed. Likewise, the pursuit of deliberate organizational change can enhance the capacity to absorb complexity.

This framework yields insights on internationalization by developing country firms that may be applicable, more generally, for the strategic management of organizations. While strategic management literature has traditionally emphasized rationality and efficiency in decision-making, this book suggests that knowledge transmission requires the presence of social communities. However, the paradox is that while knowledge transmission necessitates enhancing boundary-crossing interactions to accelerate innovation, appropriating knowledge requires that inter-organizational boundaries must be defined and constructed. Thus, by examining cross-border participation in innovation and inter-firm boundaries, this book also touches on the question of the boundary between the firm and the market and, consequently, contributes to literature on the theory of the firm.

Chapter 3 presents the research methods used and provides details about the evolving research process. The research uses a multiple case-study design to examine the factors influencing shifts in organizational practices

and processes that affect the boundaries of communities of practice in international innovation (Campbell and Stanley, 1966; Yin, [1989] 1994). Such a design is advantageous when randomization of subjects is not possible, when relevant behaviors cannot be manipulated, and when examining phenomena within a real-life context (Yin [1989] 1994). Data are drawn from over 145 in-depth interviews, observations in situ (meetings, workshops, presentations), from company annual reports and industry publications, and conferences hosted by both academia and industry.

Chapters 4 and 5 document the experience of firms in the manufacturing sector and their evolution into firms that participate in the global manufacturing arena. The first two stages of their evolution are documented in Chapter 4. Learning is both adaptive and evolutionary, leading them to become members of a global community of manufacturing firms. The adoption and replication of practices and processes, and interactions with members of the community allow them to become participants, albeit peripherally. This is an iterative process involving adaptation of behavior, dialogue, and new consciousness of what global membership entails.

Chapter 5 highlights the third stage of global expansion and integration in manufacturing firms. It suggests that, at this stage, successful technology adoptions in these firms led to the internal recognition that growth and expansion would require new strategies to enable participation in a market that was increasingly complex and no longer confined by national boundaries. Thus, new strategies and rules were adopted as moves to position these firms in international markets; in addition, organizational design had to be altered to match strategy to deal with heightened complexity.

Chapter 6 contrasts the experience of manufacturing firms with that of firms in high-technology industries. It traces the emergence and evolution of software and biotechnology firms that were global from the start and have less administrative heritage. Evidence suggests that strategy is dependent on pragmatism and that commitment to developing expertise is critical, especially when specialized expertise is lacking. The entry and integration of Indian firms into the global arena occurs via the adoption of a variety of roles – as suppliers, as partners in alliances, and as competitors of multinational companies. These roles provide a mechanism for integrating the knowledge of the community and enable the replication of the context of biotechnology and software in a new geographic location. Linkages with the United States and other locations are noted, including alliances and the movement of experts between these locations and India. Moreover, the codification of knowledge enables firms to industrialize the process of knowledge creation and develop and trade knowledge components that are used as real options in the expansion process.

In addition, in this third phase, interactions with foreign suppliers and buyers occur on a more equal footing, with greater emphasis on knowledge production and innovation. Since the environment must be sufficiently diversified to absorb the output of knowledge creation activities, at this stage there is increasing specialization in the activities of firms. Moreover, there is wider recognition that aspiration levels influence firm growth and that the level of specialization in the economy is not necessarily fixed. Consequently, this stage witnesses the rise of conscious entrepreneurial attempts by firms in developing economies to learn and grow internationally. Although specialization may be positively related to the level of growth since it requires economies of scale for global competitiveness, entrepreneurs in developing countries can aspire to become global players by using a globally distributed community rather than by remaining within national borders. A consequence of cross-border interactions is the diffusion of global practices and the creation of markets in new sectors of the economy.

The concluding chapter synthesizes evidence and provides a framework for the dynamics of internationalization and the emergence of new multinationals as a result of competition and innovation induced by multinational entry. International expansion through acquisition, subsidiaries and the ability to source work from the United States suggest that India may be on the threshold of a major leap forward. An implication is that development may follow a unique path and 'late movers' are not necessarily disadvantaged. A separate research study on biotech and software firms in the United States (Surie, 2004) provides additional insights on multinational firms and indicates an altered role for India in the international network for knowledge. I outline a new hybrid model of organization based on the Indian experience that is relevant for the requirements of societal development. I also compare India's development with that of other emerging economies like Korea, China, and Brazil, and conclude by summarizing a theory of firm growth across borders, suggesting a new interpretation of how 'national competitiveness' and 'country capabilities' are likely to evolve in the 21st century.

INDUSTRY BACKGROUND

This research was conducted in several phases. In the first phase of the research, I examined technology transfer in firms in manufacturing industries. This field study included an examination of three manufacturing firms in the steel, construction equipment, and automotive ancillary industries (such as bearings and pistons and rings) during 1993–96. Follow-up interviews were conducted on three of these firms in 2000 and 2003. The steel,

automotive, and related industries are significant in the manufacturing sector. Driven by steel-intensive economic activity in many developing economies, global apparent consumption of steel increased on average by more than 7 percent per annum since 2002 to reach 1.113 billion tonnes last year. To meet this increase in demand, steel production accelerated sharply, reaching 1.24 billion tonnes in 2006, up by 393 million tonnes or 46 percent compared to its level of 850 million tonnes in 2001. China accounts for about 32 percent of the world's apparent steel consumption. Crude steel production in China rose to 423 million tonnes in 2006 accounting for 34 percent of world production. In India, the world's seventh largest producer of steel, production reached 44 million tonnes. Russian steel production grew from 59 million tonnes in 2001 to 71 million tonnes in 2006. The share of other Asian countries (excluding China), NAFTA and the EU-25 has declined. Crude steel production in 2006 increased from 90 million tonnes in 2001 to about 99 million tonnes in the US; Japanese production reached 116 million tonnes and production in the EU-25 rose to 198.5 million tonnes in 2006 (OECD, 2007). Projected automotive capacity (2002–08) is expected to be the highest in Asia (excluding Japan; Hughes-Cromwick, 2003). Employment in the motor vehicle and equipment manufacturing industry is expected to increase 9 percent over the 2000–10 period (US Department of Labor, 2000–03). Forecasts for earthmoving equipment growth rates in 2005 (over 2004) range from about 5.6 percent worldwide, 7.8 percent in the United States, and 6.9 percent in Canada, a substantial acceleration from the rate of increase during the 1990s, driven by the ongoing economic recovery and expansion in the developing nations of Asia/Pacific and Latin America and favorable prospects of economic growth in Eastern Europe (Association for Equipment Manufacturers, 2004–05). US exports of construction equipment increased by 30 percent in 2004 compared with the previous year, an increase that represented US\$8.9 billion⁴ in equipment sold worldwide, with all regions showing double digit increases (Equipmentworld Magazine, 2005). Consequently, studying these industries is critical, particularly since emerging markets represent a large proportion of future demand.

The field study of the software and biotechnology firms was conducted during 2003. This book focuses on innovation in contexts in which tacit knowledge and experiential learning are important. Past studies suggest that biotechnology (Pisano, 2000) and software afford such a context. During 1993–99, the total R&D expenditure of publicly traded genomics firms grew 48 percent per annum (OECD, 2001). From 1996–99, US biotechnology trade grew by 13.2 percent a year on average, whereas technology transactions increased by 9.5 percent and total trade by 6.5 percent. The United States is a net exporter of biotechnology products and remains

a leader on the international market. The share of biotechnology in the technology trade surplus is twice as large as its share in technology trade (0.9 percent), suggesting a US trade specialization (*ibid.*).

Similarly, the software industry, which is part of the information and communications technologies (ICT) sector, accounts for a large and growing share of investment and contributed significantly to output growth, particularly in the United States, Australia, and Finland in the late 1990s (OECD, 2002). Software firms are the most R&D-intensive of ICT firms, important recipients of venture capital (up to 20 percent of total technology venture capital in the United States, over 30 percent in Europe) and increasingly active in patenting. In the United States, software-related patents now account for between 4 percent and 10 percent of all patents, depending on how they are counted (*ibid.*).

Both industries are also rapidly gaining importance in India. The Indian IT services industry, which began in the mid-1970s, reached the US\$10 billion mark in 2002 and was targeted to reach US\$77 billion by 2008 (NASSCOM-McKinsey report, 2002). The bulk of the growth was driven by exports, which grew from US\$2.6 billion to US\$7.8 billion at a growth rate of 43 percent per year from 2000 to 2002 (*ibid.*). Worldwide spending on IT was estimated to have grown from US\$1384 billion in 2004 to over US\$1479 billion in 2005, a growth of nearly 7 percent over the year. Services, comprising IT services, product engineering and business process outsourcing (BPO) account for a dominant share (approximately 58 percent) of worldwide aggregate spend and form the fastest-growing segment (growing by 8 percent in 2005; NASSCOM, 2006). Indian IT exports grew from US\$13.3 billion in 2003–04 to US\$18.2 billion in 2004–05. Software and services exports are projected to grow at 32 percent in the current fiscal year (*ibid.*).

Similarly, biotechnology is an emerging industry in India. It accounted for just 2 percent of the global biotechnology market in 2003 and is estimated to grow exponentially over the next five years, with an expected global market share of 10 percent. The first Indian biotechnology company was established in 1978; currently there are over 150 biotechnology companies. Biotechnology is considered to be the next major driver of growth and the Government of India (GOI) has taken special initiatives to promote India's biotech industry. In addition, the biotech research plan outlay has been doubled from INR6.22⁵ billion in the Ninth Plan (1997–2002) to INR14.5 billion in the Tenth Plan (2002–07). Apart from funding, the GOI has eased the regulatory framework by approving genetically modified crops, recombinant-DNA products (rDNA) and ethical stem cell research (ICFAI, 2005).

AREAS OF CONTRIBUTION

This book contributes to a deeper understanding of processes underlying internationalization and highlights the relevance of interactions between industrialized and developing countries in contributing to building capabilities and competitive advantage. The introduction of new technologies and innovations from external sources acts as a catalyst for new action in a traditional context, raising local aspirations and catapulting the firms with the strongest capabilities to the next stage of evolution. From an evolutionary perspective, exposure to new ideas alters the behavior of the system just as a problem-solving organism changes its behavior by permitting invalid assumptions to be discarded (Popper, 1963). The book thus suggests that behavioral changes are accompanied by changes in cognitive assumptions through action and links micro-level behavior with macro outcomes. In this respect, the book contributes to an understanding of the mind-body problem of philosophy in organizational and socioeconomic contexts. It also highlights the implications for transforming societies when changes in organizational practices usher in new cultural values.

The book also proposes a different theory of decision-making than one suggested by classical economics, by emphasizing that technology selection and decisions to innovate or participate in markets result as much from heuristics of aspiration adjustment as from rational search and optimization. Moreover, using bounded rationality heuristics rather than an optimization view of decision-making contributes to the robustness of the new system rather than to its failure because the resulting externalities yield societal benefits.

Finally, the book contributes insights on the theory of the firm by showing how the boundaries of the firm are extended through the creation and replication of communities of practice across borders. Such communities facilitate the generation and diffusion of knowledge both in and across firms. Knowledge transfer, absorption, and creation lead to the emergence of new identities and involvement in activities that speed the internationalization of firms in growing industries. Entrepreneurial firms source new knowledge and leverage capabilities through boundary-crossing interactions with other organizations (e.g., firms and institutions). The expansion of the boundaries of the firm via strategic alliances, joint ventures, and subsidiaries across borders also mirrors a restructuring or contraction in other firms and industries. Thus, it provides insights on the processes underlying shifts across industries through strategic action by firms in a developing economy.

NOTES

1. The book draws on studies conducted during this period (Surie, 1996; Surie and Singh, 2004).
2. The resource-based literature discusses resources in terms of their contribution to a firm's ability to use them in ways that make it difficult for competitors to imitate its products or services (see Dierickx and Cool, 1989; Barney, 1991). Resources can include core competencies that provide firms with similar advantages (Prahalad and Hamel, 1990).
3. These stages are used to communicate differences between levels of learning and change. A staged approach to evolution does not imply that progress is inevitable, neither does it preclude regress. Thus, growth and exit are equally possible.
4. Billion = one thousand million.
5. Indian rupees.