CHAPTER II
REVIEW OF LITERATURE

The structure, performance, and competitiveness of Indian IT industry has been studied by a large number of researchers. There is no dearth of published literature. The review of literature has been carried out to understand this industry and the potential it offers for further research.

The review of literature is broadly divided into three parts:

Part I examines the literature pertaining to the origin, evolution, performance, growth, trends, constraints and challenges of the Indian IT industry.

Part II examines critically the Porter’s Diamond Model theory as a tool for strategic management scholars used extensively to measure industry structure and competitiveness.

Part III examines the literature which is extensively used for performance evaluation and benchmarking of industry.

PART I

2.1 REVIEW OF STUDIES RELATED TO ORIGIN, PERFORMANCE AND GROWTH OF INDIAN IT INDUSTRY

Schware (1992) touched upon two vital themes pertaining to software industries across nations. First, countries without an active and up-to-date software sector would find it difficult to “catch-up” in terms of capital outlays, labour skills, and technology changes nor would they have the software management experience to undertake complex projects and have product development alliances with dominant international players in the sector. They would also have a weak institutional and support infrastructure for marketing. Second, the learning curves for domestic and international market activities are quite different, the domestic software market being an important base of skills and
experience to be later applied to exports. The development strategies of Brazilian and Indian software industries were studied. Both nations tried to “walk on one leg”. Brazil walked on the domestic leg whereas India the export leg. Potential of these countries to move to two legged model is assessed. Countries need to pay greater attention to domestic opportunities, since the returns in terms of experience, training and innovation broadens exports. However, there is little evidence that experience with complex domestic projects in India had a payoff in export market or that the “learning to walk on two legs entry strategy” was being practiced by Indian firms.

Evans (1992) chronicled the evolution of state involvement in the Indian informatics industry during the 1960s, 1970s and 1980s. While the Indian state combined restrictive regulation with attempts to substitute state-owned for private production during the 1960s and 1970s, conscious attempts were made to promote private entrepreneurship during the 1980s. Illustrative comparisons with state involvement in South Korea and Brazil suggested that this trajectory of change had relevance beyond India.

Nonaka & Takeuchi (1995) posit that explicit and tacit knowledge are not mutually exclusive but complementary entities and knowledge can be converted from one form to the other. The knowledge creating process is a dynamic spiral that moves from the individual to organization and inter-organization dimension. The Socialization-Externalization-Combination-Internalization (SECI) spiral was used by Japanese companies to create the dynamics of innovation.

Correa (1996) discussed the economics of software development and the factors that influence the viability of an export-oriented software industry in developing nations. The experiences of a number of Latin American and Asian countries in the production and export of software were analyzed. The case of India, the main software exporter in the developing world, was considered in detail. It was found that though the entry barriers were low, the countries seeking to develop software businesses were constrained by internal factors, like small domestic markets, small firm size, absence of quality standards, weak protection of property rights, low quality labour and infrastructure and poor marketing skills. The constraints of some external factors, like US dominance
monoplies and English language barriers were also largely visible. To conclude, different software export strategies and their relative advantages for developing nations were presented.

Mowery (1996) offered the first comprehensive, cross national analysis of the origins, structure, and competitive strengths of the US, Japanese, British, Western Europe and Russian computer software industries. He examined in detail the role of US government policy in supporting the emergence of the US software industry, the interaction between software and hardware in technology commercialization and the changing structure and influence of intellectual property rights within the industry.

Heeks (1996) provided the first critical analysis of the development of Indian software industry. A detailed history of the government’s role in India’s industrial development was studied. He concluded after examining a wealth of facts and figures that liberalization had brought in only limited benefits. A successful software industry required state intervention of a promotional nature. He also studied the development of India’s computer industry because of intimate connection between hardware and software. Recommendations for the growth of the industry both in India and other developing nations were made.

Arora & Asundi (1999) investigated the relationship of ISO certification to organizational performance. Using data on 95 Indian software firms and their US clients, it was concluded that ISO certification enhanced firm growth. The results provided partial support for the proposition that ISO certification also enhanced revenue for a given size, suggesting that firms received a higher price per unit of output. This conformed with the notion that ISO certification does enhance the quality of output and defined systematic processes of software development.

Arora et al. (2000) focussed on Indian software export sector. The objective of the research was to study India’s success story and the implication of the Indian experience for both, the developing and the developed nations. The analysis was based on field visits to over 20 Indian firms in Bangalore, Bombay, Hyderabad and Delhi, where about 75 senior managers and software professionals were interviewed. It was followed
by interviews with 15 US based firms that had outsourced software development to these firms in India. The field research was complemented with publicly available data on firms (NASSCOM, 1994-98), as well as information from a questionnaire survey administered to over a hundred Indian software exporters. It was found that the rapid export growth was difficult to sustain. The domestic markets provided far more challenging projects but its connect to exports was tenuous. There was little evidence that experience with complex domestic projects generated high payoffs in the export market or that “learning to walk on two legs entry strategy” (Schware 1992) was being practiced by Indian firms. These observations were consistent with the other research in this area (e.g. (Heeks 1996); (D’Costa 1998)). Both these authors argued that the export orientation and routine tasks that exports involved had limited learning potential for Indian firms.

Heeks noted that the reported export revenues were misleading. A substantial fraction of these revenues were earned onsite and these were spent outside India. The impact of Indian software industry on the Indian economy was reported to be indirect. It showcased the new business organizational form which industry at large emulated.

**Chakraborty & Jayachandran (2001)** studied the structure, trends and constraints of Indian software industry. Based on a survey of software-related companies in major cities of India the paper critically examined the organization and size of the industry. It was found that the industry is represented mainly by private domestic firms, majority of which are small in terms of their assets and earnings. It was also revealed that more than 80% of the revenue was generated in the export market. Further, the export market in the US accounted for 60% of the export revenue. The compositional breakdown of exports indicated that the industry relied mainly on software services export and lacked diversification in packaged software products. This was in sharp contrast with the export pattern of its competitors in Asia and Latin America. With regard to future trends it was suggested that growth potential of the Indian software industry would depend upon the degree of reform in infrastructure planning and regulatory rules.

**Arora, Gambardella & Torrisi (2001)** compared the development of software activities in India and Ireland, with the Silicon Valley (SV) model. Two surveys of the
domestic and foreign-owned firms in the follower countries were carried out. The most obvious advantage that emerged in these nations was their ability to sustain growth without the broad-based set of technical capabilities. The leaders created and defined markets, the business models, policy and technical infrastructure. Agglomeration effects emerged over time. This attracted large inflows of foreign venture capital and encouraged the entry of new and innovative firms. These nations had similar capabilities with little differentiation. The sources of competitive advantage were narrow. These nations transferred the lion’s share of benefits to overseas customers. The sophisticated and established competitors located in leading clusters stood in the way of the follower nations and hindered their movement up the value chain. These innovative firms were left to search for new niches and ways to link to new users. The absence of horizontal links (with complements in other industries and rivals) and vertical links (with input suppliers and customers) compared to the Silicon Valley model, contrasted these nations. Nevertheless, the head start enjoyed by Indian and Ireland staved off the challenge from the followers. The early success of these nations paved the path for their future growth.

**Arora, Gambardella & Torrisi (2001)** reported on the results of research conducted on the Indian Software Services industry. The questionnaire survey, supported by field visits and interviews with industry participants, observers and US based clients was used to study the industry growth and success. A spectacular growth of the Indian Software Services industry was observed. The prospect of short-term gain offered by simple service export, seduced Indian firms away from making substantial investment required to develop products and move up the value chain. The absence of sophisticated domestic market further aggravated the problem. This coupled with shortage of engineers constituted a serious impediment to sustained industry growth. These challenges were not insurmountable. Suitably trained non-engineers, whose supply is more elastic, were substituted. The mounting wage pressures were also addressed. It was concluded that Indian firms developed tools to reduce costs, improved software development practices, provided value-added services beyond simple coding and invested in research and development of new products.
Chakraborty & Jayachandra (2001) provided an analytical framework for examining the organization and size of the Indian software industry. Its growth pattern and government initiatives have been outlined. The study was based on the survey of 68 software-related companies in the major cities of India. It was found that foreign participation in terms of joint venture corporation or subsidiary organization remained limited. The size of assets of most companies were less than Rs. 300 million. Only a few corporations earned revenue in excess of Rs. 500 million. The group of firms examined in the study accounted for a meager 0.01% of national employment. The domestic market explained only 17.5% of the total revenue and contrasts strikingly with that of the developed countries of United States, Western Europe and Japan. More than 60% of industry revenue was generated in the US market. The software exports were further skewed towards custom software and programming services. The government’s policy initiatives during 1990s were discussed.

Heeks & Nicholson (2002) studied the export success factors and strategies in Developing and Transnational Economies (DTEs). The purpose of the paper was to analyze and expose strategies and result of both first and second-tier software exporters. The perceived winners in the first-tier were led by 3Is-India, Ireland and Israel. There emerged a set of second-tier nations, ensued by the first-tier nations. The methodology adopted was the analysis of country case studies drawn from fieldwork, writings from India and from secondary sources. The ‘Software Export Success Model’ was developed after assessing the experiences of the leading players (3Is) in the first-tier. This model was used to investigate the strengths and weaknesses of the three second-tier exporters-Russia, the Philippines, and China-which expanded operations particularly during the 1990s. Lessons were drawn both for the studied countries themselves and for others DTEs: those like Hungary, Jordan, South Africa and others which identified themselves as the third-tier aspirants and also others - the majority of would-be software exporting nations. It was found that the vision and strategy of the three Is do not overlap. The sustaining strategy for India was software services, then climbing up the value chain; for Ireland was product-related services for multinationals, then diversification; for Israel was home-grown product exports,
then innovation and differentiation. This differentiated branding helped these nations to succeed as simultaneous first movers in software.

**Arora & Athreye (2002)** assessed the contribution of software industry to India’s economic development. The rapid growth of the industry was a consequence of India’s comparative advantage in the production of software services, rather than merely a result of an absolute advantage in terms of wage differentials. The comparative advantage hinged on, the availability of a large workforce that was English speaking and technically trained; and also on, the relative disadvantage that the economy had in manufacturing due to poor past investment in infrastructure. The larger the size of the disadvantage, the more it paid the country to specialize in software. The transfer of resources from poorer productivity to higher productivity sectors spurred the growth process. The south and west of the country witnessed higher rates of income growth because of software industry concentration in these regions. These factors favoring software exports from India were further reinforced by the low domestic demand for products and services. The structure of Indian software industry remained largely undifferentiated. To gain competitive advantage, the quality of procedures and human resources, public investment in basic and secondary education, private and public investment in the provision and acquisition of tertiary training and investment in physical infrastructure is necessary. The industry’s macro economic contribution to employment and foreign exchange remained less visible. It pioneered the innovative models of entrepreneurship, organization and corporate governance, which spread roots to the rest of the Indian industry and were a source of its productivity improvement. These long term benefits for India’s industrialization and growth were indeed, powerful.

**Dayasindhu (2002)** developed a dynamic theoretical framework for global competitiveness. This framework was used to assess competitiveness of the organizations in the Indian software industry. The case study methodology was used. A detailed analysis of a single case on the Indian software industry was the focus of this research. This research was based on information collected via in-depth formal and informal interviews and published material. It was found that organizations to be globally competitive must evolve strategies to build relationships with other organizations,
promote knowledge transfers and create industry clusters. Global competitiveness is achieved by increased productivity, focused direction and increased pace of innovation and growth.

**Athreye (2002)** studied the catalyzing effect of multinational firms in the evolution of Indian software industry. The foreign firms established by expatriate Indians too exerted competitive pressure. The tight labor markets due to foreign competition induced domestic firms to acquire unique organizational capabilities. These firms were also engaged in improving the value-adding strategies of the multinational firms. It was concluded that this competition had a deep and transformative effect on the evolving industry.

**Stillwell (2003)** commented on the work of Ikujiro Nonaka, a Japanese scholar who has written about large business organizations. He developed Michael Polanyi’s conception of tacit knowledge in a practical direction to enhance organizational “knowledge creation”. His spiral process described disciplined practices that made tacit knowledge independent and available to restructure the organization knowledge context. It was concluded that Nonaka’s work had a potential for radically changing institutions (not only businesses) and the consequent members. The conceptualization of tacit dimension by the West could be different. Intangible knowledge had no value until embodied by people immersed in situations of living and doing.

**Carmel (2003)** introduced the “oval model” that incorporated eight factors that led software industries to export success. The eight factors were government vision and policies, human capital, wages, quality of life, linkages, technological infrastructure, capital and industry characteristics. Some of these factors were overlapping and some were interrelated. The many nations that strived to succeed in software were labeled, the “new software exporting nations” (classified into four tiers in (Carmel 2003)). This model explained the success of Israel, India and Ireland, who have already succeeded in software industry. It also provided a framework for prescriptive policies and strategies for scores of those nations endeavoring to craft success in this industry (Carmel 2003). The oval model is unique in the sense that the success factors are applied to tier3 (emerging nations) and tier4 (infant stage software exporting nations); human factor is emphasized;
secondary factors such as piracy is de-emphasized; factors such as quality of life are added. The future of new software exporting nations is assessed. The nations in the lowest tier face a more daunting challenge.

Dossani (2005) explained the origin, growth and sustainability of India’s software industry. The key global events influencing the industry were reviewed. It was found that industry growth which happened in the mid 1980s was preceded by a paradigm shift in government policy supporting private sector. The maturation was enabled by the modularization of the programming function through new technologies. Policy reforms in the 1990s and 2000 reduced import tariffs to near zero and standardized foreign ownership, intellectual property protection, venture capital, stock market listing and telecommunications policies to global best practices. In addition, technological changes during this period, particularly the Internet, led to a sharp decline in data storage and transmission costs. These policy and technological changes induced transnational entry, diaspora and foreign venture capital entry which led to more product development and higher value-added output. The implantation of a technically sophisticated industry like software into a less-developed host countries was explained by the transnational corporations’ access to local resources facilitated by policy reforms.

Athreye (2005) described the evolution and growth of outsourced service capabilities in Indian software firms. The dynamic capabilities framework outlined by (Teese, Pisano & Shuen 1997) was of immense use. The triad of factors that influenced the development of firms’ competitive advantage were: firms’ internal processes (organizational and managerial); firms’ (asset) positioning in the market; and the paths opened consequent on the first two factors. The main sources of quantitative data was the published data provided by NASSCOM and further information was gathered from national newspapers: Business Line, Business Standard and the Economic Times. The qualitative information was obtained through interviews conducted by the authors in firms and also data drawn from interviews in software firms conducted by other researchers was used. The case study on Indian software industry concluded that comparative advantage due to favorable factor endowments became ‘created’ comparative advantage in outsourcing, resting on the organizational capabilities of a few
large software service firms. The study emphasized the role played by tight labor market conditions in inducing investment in process capability.

**Arora & Gambardella (2005)** examined the growth of software industry in five emerging economies of India, Ireland, Israel, Brazil and China. It was found that industry growth in India, Ireland and Israel was fueled by exports. In China and Brazil, exports were based on competencies nurtured and developed by serving the domestic market. The software services have allowed these nations to participate in the hi-tech sector with limited physical infrastructure. Nevertheless, the software industries in these nations accounted for 2-3% of their respective GDP and even a smaller fraction of employment. It has been found out that most of the successful software firms in the 3Is, modeling themselves after the Silicon Valley counterparts, have stressed share-holder value, responsible and transparent corporate governance and accounting. The task for any underdog region is probably easier today than at any time in the past. It was concluded that the US technological leadership dwindled with increasing attractiveness of foreign emerging economy destinations.

**Arora (2006)** described the evolution and growth of India’s software industry. The factors contributing to the success of the industry were identified. The prospects of the industry were also summarized. The extent to which Indian firms participated in software innovation and provision of higher value-added products and services were assessed. The direct and indirect impact of the industry on the Indian economy were identified. Three sets of value-added activities in software were distinguished. First, the design and development activities; software firms including Microsoft, Adobe, Oracle and SAS operate in this value chain. Second, the custom programming, software analysis and design for clients including the custom development of software products; significant set of firms operate in these activities. Total value created and employment generated was much larger in this segment. Third, the users of software constituted an important set of activities.

**Aspray, Mayadas & Vardi (2006)** studied globalization and offshoring of software. It was found that advances in computer science and technology were successful in forging a global market. The data and voice communication costs were negligible; web
features provided information to anyone, anywhere, anytime; hardware cost were low making information technology affordable; curricula was standardized and educational material widely available; and software standards enabled different machines and systems to interoperate. Globalization of and offshoring within the software industry continued to increase. This increase was fuelled by information technology, government action and economic factors. Global competition, both in lower-end software skills and higher-end endeavors such as research were witnessed. The business imperative: profits, shareholder value and inter-company competitiveness continued to play a dominant role. The current data and economic theory suggested that career opportunities in the industry would remain strong. Labor could be sent over a wire and physical relocation would not be required. The individuals, companies and countries should invest in building the foundations that foster innovation and invention.

To conclude the above section, literature review pertaining to the IT industry’s origin, evolution, performance, growth, trends, constraints and challenges has been carried out. It made us comprehend the structure, complexities, competencies (both operational and organizational) and resource endowments of the Indian IT industry. Its potential for leapfrogging, moving up the value chain in a short span of time, being an exemplar for new business model and enhancing global brand equity – an imprint of all these and many more issues are obtained in a shot by this review. The positive role of the government to sustain and boost the countries competitive edge and to take it to a higher pedestal in the global markets is clearly visible. It is seen that the Indian IT industry has the ability to push itself and the nation onto a much higher growth orbit.

PART II

2.2 REVIEW OF PORTER’S DIAMOND MODEL THEORY AS A STRATEGIC MANAGEMENT TOOL USED TO MEASURE INDUSTRY STRUCTURE AND COMPETITIVENESS

Dunning (1988) distinguished three categories of multinational enterprises (MNE) operations in foreign countries: 1) resource-seeking, 2) market-seeking, and 3) efficiency-seeking. The first two categories were similar to those proposed by (Porter &
Monitor Company, 1992) but in the third one (Dunning, 1988) explained that efficiency-seeking is about international production integration and operational optimization, where supply management is crucial. The efficiency-seeking stage of (Dunning, 1988), share some of the characteristics mentioned by (Rugman & Verbeke, 1993), (Dunning, 1993), (D'Cruz, 1986) and (Fleck & D'Cruz, 1987) the variant being whether the host country produces only one part of the supply chain worldwide or the entire product for the countries that belongs to the regional bloc.

**Miller (1990)** was of the opinion that like Porter’s earlier work “The Five Forces Model” to assess industry attractiveness, “Porter's Diamond Model” to measure industry competitiveness did not present a new thought. But his analytical framework was new and powerful. It was developed by studying competitive performance of ten nations (Denmark, Germany, Italy, Japan, Korea, Singapore, Sweden, Switzerland, the United Kingdom and the United States) each involving between 5 to 19 industry cases. These multiple comparative case studies across nations helped him to develop an innovative and empirically relevant theory/framework.

According to **Grant (1991)** Porter had built “a bridge between international economics and strategic management.” Whereas, economist usually studied a country as a whole with macroeconomic indicators like the GDP, interest rate and inflation rate; the strategic management or international management scholars studied firms, managers, and national cultures. In his book “The Competitive Advantage of Nations” Porter (1990) focused on clusters or industries as the unit of analysis that promoted the competitiveness of countries. The theory of competitive strategy had the potential to rescue international economics from its slide into irrelevant theoretical rigor and superficiality of policy prescription.

**Porter & Monitor Company (1992)** analyzed the international competitive position of Canada. They studied the evolution and international competitive performance of 25 Canadian industries representing various regions and sectors of the economy. Using the analytical framework developed by Porter (1990) in his book “The Competitive Advantage of Nations”, the sources of Canadian competitive advantage were examined. It was concluded, that the traditional Canadian economic order was under
tremendous strain because of sweeping changes in global competitive environment: rapid growth of trade and investment, more open competition, the globalization of industries, shifting corporate strategies, rapid technological change, and increased economic integration among countries. It was further found, that no simple solution to the competitiveness issues confronting Canada existed. The country had to draw upon its many strengths: talented and relatively youthful population, the nucleus of internationally successful firms, the opportunities afforded by proximity to the enormous US market and a legacy of past achievements in various fields.

Dunning (1992) in the review article “The Competitive Advantage of Countries and the activities of Transnational Corporations” focused on Micheal Porter’s book entitled “The Competitive Advantage of Nations” (Porter 1990) and its limited appeal in the explanation of the growth and the influence of transnational corporations (TNCs) on the competitiveness of countries. The purpose of the review article was to examine the relevance of Porter’s thesis to our understanding of international business activity. Dunning had particularly sought to identify the ways in which the national diamond of competitive advantages are linked to each other by the operations of TNCs. The distinctive impact of these corporations on the resource allocation, usage and competitiveness is immense. It was suggested that the transnational business variable should be considered as a separate factor influencing the configuration of the advantages accruing to nations. Competitiveness was affected by the ownership structure of firms and cross-border markets.

Rugman & D'Cruz (1993) developed the double diamond model, as an extension to Porter’s diamond model (1990). It was found that many economies that opened to international trade do not have strong national diamonds. Instead they have at least one weak corner of the national diamond which relied on the corner of the foreign diamond. Canada’s experience was illustrated. The absence of strong demand conditions in its national diamond made it rely on the strong and sophisticated demand of the US diamond. Likewise, some countries which are weak on one corner of its diamond, link in terms of this determinant to other countries diamond. The phenomenon that the
determinant of the competitiveness of some countries were complemented by other countries, was the inevitable consequence of globalization.

Cartwright (1993) studied the competitiveness of New Zealand’s dairy industry which successfully exported to more than 100 countries. It was found that its national diamond was weak or moderately weak in at least three of the determinants. Thus, the New Zealand’s dairy industry relied on sources of competitiveness that came from diamonds different than its own. The ‘multiple linked diamond’ therefore determined the countries competitiveness in dairy industry. Some developing countries also have diamonds linked to another country’s diamond. The case of Mexico was discussed by (Hodgetts, 1993).

Dunning (1993) internationalize Porter’s diamond model. The MNEs use several diamonds (trans-nationalize) to strengthen the corners of their home diamond. Their activities hence bring about regional integration among countries. He suggested that MNEs motive to invest in a country is not just to have access to new markets or secure national resources but to seek greater efficiency.

Moon, Rugman & Verbeke (1995) suggested that the Porter’s diamond framework (Porter, 1990) is of use in a single country context but, since much of the nations’ activity takes place in a regional, international or global context, it is important to consider the trade relationships between countries to gain a full analysis at the nation level. A new approach, the generalized double diamond model (Moon, Rugman & Verbeke, 1995) offered some important extensions to Porter’s original model. It explicitly incorporated multinational activity, both outbound and inbound foreign direct investments (FDI). The new approach easily allowed to operationalize the competitive paradigm. It included government not as an exogenous parameter, but an important variable which influenced the four determinants of the model. To test the validity of these two models this paper evaluated relevant data for both domestic and international variables in case of Korea and Singapore. The results supported the specialized double diamond model.
**Porter (1998)** posits that understanding industry clusters helped organizations to make more informed decisions on choosing locations and fostered productive relationships in those locations. They affected competition by increasing the productivity of companies based in the area. Also, the direction and pace of innovation under-pinned future productivity growth. They stimulated the formation of new businesses which in turn expanded and strengthened the cluster. Each member of the cluster benefited as if it had a greater scale. These clusters offered a constructive way to change the nature of the dialogue between the public and private sectors. An alternative way of organizing value chain emerge. He mapped US, Italian and Portugal clusters.

**Ramachandran & Yip (1998)** found India to be an attractive destination for multinational corporations (MNCs) promising big payoffs. After forty four years (1947-91) of outright hostility to free markets and foreign companies, India finally gave markets and MNCs a chance. India emerged as a preferred destination for domestic, as well as overseas investors, because of being characterized by a large market, English speaking skilled workforce and a solid middle class of two hundred million Indians. The western accounting and legal system were an added advantage. India’s global strategic importance is supported by market, cost and competitive globalization drivers, yet MNCs must understand Indian environment, enter now and reap benefits as they go along.

**Momaya (1998)** developed a methodology for evaluating relative competitiveness at industry level with special reference to construction industry in Canada, Japan and the United States. To enhance the understanding of competitiveness, it was divided into three facets: assets, processes and performance. Statistical data about the construction industries in the three countries, along with a questionnaire survey in these nations captured the valuable component of the overall picture of competitiveness. Out of the 38 criteria considered in the study, 22 were based on a questionnaire survey and the rest were statistical. Comparative data on these parameters for 1990-1993 were collected for these countries. The methodology of standard score was used to calculate the relative competitiveness of the three countries. It was found that Japan put enormous emphasis on improving processes to leverage their strengths in assets. In contrast, the North Americans focused on performance. It was further concluded, that appropriate adaption
Review of Literature

of Japanese management practices can help improve the international competitiveness of India.

**Davies & Ellis (2000)** in what they call “the time for final judgment” reviewed critically the “Competitive Advantage of Nations” (CAN) by drawing upon the papers written since the publication of the original theory by Michael Porter in 1990. It was found that the book had conceptual flaws particularly of elision for a theory to amount to more that a useful taxonomy. Subsequent empirical studies refuted the theory’s major assertions. Sustained prosperity could be achieved by nations without becoming ‘innovation-driven’. Strong ‘diamonds’ were not in place in the home bases of many internationally successful industries. The claimed integration between international economics and strategic management rested upon the wrong attempt to substitute ‘competitive advantage’ for ‘comparative advantage’.

**Ghoshal, Piramal & Bartlett (2000)** in their book “Managing Radical Change: What Indian Companies must do to become World Class” examined a country rapidly emerging as a new superpower. The objective of the book was to synthesize the current state of management knowledge with Western best practice. Case studies of HDFC and Infosys showed that these organizations flourished under the respective leadership of the icons Mr. H.T. Parekh and Mr. N.R. Narayana Murthy. The Indian companies following a pattern of best practices became outstanding global competitors. These new companies adopting radical change offered relief for many Indians still caught in the iron cage of bureaucratic organizations.

**Kapur & Ramamurti (2001)** studied the performance of skill intensive Indian IT industry where domestic demand conditions were less favorable. The network of customers based abroad (largely in the US) created a “virtual diamond” linking Indian supply with US demand. The liberal policies of the government for this sector strengthened intense rivalry in the industry, one of the four determinants of Porter’s Diamond model. The industry structure was well dispersed with the large players and a good number of small and medium players. It also explored the contribution of overseas Indians to India’s skill intensive service exports. The contribution of overseas Chinese to China’s manufactured goods exports was compared. It concluded that the most promising
opportunities for foreign investors would lie in the knowledge based and skill-intensive service export software industry.

Porter (2001) established that regional economies/clusters are the building blocks of US competitiveness. The Clusters of Innovation Initiative project measured the relative strength of five US regional economies. The clusters in these economies were studied and their economic and innovation performance over time tracked. The influence of these clusters on region’s economic future was measured. The strategy and action programme developed by these regions to drive its economy and clusters forward and the broader implications for the US economy were examined. The database developed at the Institute for Strategy and Competitiveness at the Harvard Business School was used.

Shee, Momaya & Banwe (2002) suggested a framework for measuring competitiveness. A systematic review of large volume of literature available on the subject was carried out. Quoting case studies of IT industry leaders like Infosys and Wipro, it was found that these organizations presented “benchmark human resource practices in managing knowledge workers in the industry”. An overview of measurement methods was provided, standardization of which was difficult due to the multi-faceted dimensions of competitiveness researched by authors from diverse disciplines.

Economic Commission for Latin America and the Caribbean (ECLAC) (2004) developed a framework to analyze transnational corporations’ (TNCs) corporate strategies to invest in Latin America. The technological asset-seeking category was conceived being an extension to (Dunning, 1988) efficiency-seeking category of MNE operations in host country. The main motivation of TNCs to shift the host base was found to be technology expertise and R&D. These corporations also sought to take advantage of international trade agreements to have access to export markets from host country.

Snowdon & Stonehouse (2006) provided the text of an interview with Professor Michael Porter discussing his research and ideas relating to the microeconomic foundations of global competitiveness. The discussion of this paper provided insights on some of the key issues relating to recent research on competitiveness, productivity, clusters, US economic leadership, economic growth and development.
Heeks (2006) focused on the application of Micheal Porter’s theory of competitive advantage, based around his well-known “diamond” of determinants, to the case of India’s software industry. Analysis of the Indian case suggested that the key sources of competitive advantage were: ever improving advanced skills, rivalry, clustering and government vision/policy. The emergent challenges to Porter’s theory and some amendments to Porter’s original ideas were identified. These in turn assisted researchers and analysts on when, why and how to apply Porter’s competitive advantage theory to analysis of IT sectors of developing countries.

Smit (2010) focused on the meaning of international competitiveness at the country level with the context of (Porter, 1990) thesis that countries, like companies compete in the international markets for their fair share of the world markets. The article reviewed the literature related to trade (economic perspective) and international competition (management perspective) at a country level. It was found gains from trade came through specialization due to comparative advantage or economies of scale (internal and external) and not at the expense of other countries. Therefore there is no reason to believe that countries like firms are in some sort of competitive battle with one another. Porter’s diamond framework, on the other hand, provides the link between firm and country specific sources of competitive advantage that firms leverage to gain international competitive advantage. It was concluded that most of the requirements for an internationally competitive diamond were missing in the Indian software industry, compared to the US diamond. The industry is relatively more important in India than in the USA and thus attracts the best resources in India. India has comparative advantage in the software industry. It was further explained that Porter’s Diamond framework is not a new theory that explains the competitiveness of countries but rather a framework that enhances our understanding of the international competitiveness of firms. A valuable contribution of Porter’s Diamond Framework is from the management perspective rather than the economic perspective.

To conclude, Porter’s diamond framework synthesizes our understanding of country sources of competitive advantage, competitive strategy (Porter, 1980) competitive advantage of firms (Porter, 1985) and the resource based view of the firm
Review of Literature

((Penrose, 1959); (Wernerfelt, 1984); (Ghemawat, 1991); (Dierckx & Cool, 1994); (Lockett, Thompson & Morgenstern, 2009)). Porter is highly commended for his work. He is placed among the top four management strategy thinkers along with Tom Peters, Peter F. Drucker and Kenichi Ohmae (Economist, 1990). The strategic management scholars have extensively used the Porter’s diamond model to study industry structure and competitiveness. Vast empirical studies support its use and application. The growth of academic literature since the publication of Porter’s Competitive Advantage of Nations (CAN) 1990 is commendable. The corners of diamond are being constantly upgraded. The key message of Porter’s study is that one must contest against the most powerful opponents to become true champions, sell to the most demanding buyers, value human resources shaped by government policies and/or corporate strategies and overcome the toughest regulatory hurdles. The role of government is envisaged as “pushing and challenging rather than protecting and subsidizing”.

PART III

2.3 REVIEW OF LITERATURE PERTAINING TO PERFORMANCE EVALUATION/BENCHMARKING TECHNIQUES AND THEIR APPLICATION IN INDUSTRY

Sherman & Gold (1985) investigated the use of Data Envelopment Analysis (DEA) technique to study bank branch productivity. The objective of the study was to measure and evaluate the operating efficiency of 14 branch offices of a savings bank without using standard cost information. The output measure used in the study was the number of transactions of each type processed by the branch. Of the 17 transactions listed in consultation with bank management, these were grouped into four outputs. Data was collected for the number of transactions of each type processed by each branch during the fiscal year. The three inputs identified by management were labor, office space and supply costs. The results suggested that DEA is a beneficial complement to other techniques used for measuring bank branch efficiency. The results of the analysis were discussed with management in light of their knowledge of these back branches and suggestions offered to improve operating bank branch efficiency. The DEA results helped
to quantify some of the weaknesses consistent with the intuition of the management. Rental costs were less controllable than personnel and supply costs. Part of the personnel inefficiencies in inefficient branches were due to clustering of customer transactions which placed added demands on these branches in certain time periods. The results suggested that reduction in supply costs in just four branches, would bring down these costs considerably.

**Land, Lovell & Thore (1994)** estimated the intertemporal productive efficiency of the 44 large computer manufacturers in US using financial data for 1981-1990 brought from earnings statements and balance sheets. The data employed was collected from Dow Jones COMPUSTAT PLUS data base. The results indicated that some corporations, including Apple Computer Inc., Compaq Computer Corporation and Seagate Technology were able to stay at the productive efficiency frontier throughout the period investigated. The Sun Microsystsems consistently was sub-efficient since its introduction at Wall Street, yet the growth was remarkable. It was concluded the corporation sacrificed efficiency for the rapid growth. Subsequently, a new Malmquist type productivity index was calculated for each corporation to measure shifts of estimated intertemporal efficiency frontier. The novel feature of the study was the use of standard financial data base to carry out DEA calculations.

**Fethi, Jackson & Weyman-Jones (2000)** assessed the efficiency of European airlines using data envelopment analysis (DEA). The scale and pure technical efficiency were not disaggregated since subsequent Tobit regression analysis incorporated factors related to both scale and scope in explaining the relative efficiency scores. For the purpose of analysis three inputs and two outputs were used. The inputs were available tonne kilometre (ATK), operating cost (OC) and non-flight assets (NFA). The outputs were revenue passenger kilometre (RPK) and non-passenger revenue (NPR). The potential determinants of European airlines performance/efficiency were classified under five broad headings. First, lack of competition was believed to induce inefficiency. Three measures were used to estimate the effects of competitive conditions on inefficiency: firm concentration; openness of the market; and the rate of contestability. Second, the managerial and organizational factors included the ownership structure and the extent to
which the organization is unionized. Third, the structural heterogeneity between organization could lead to efficiency differences. Fourth, the dynamic factors fostering efficiency were R&D facilities, innovation and market growth. Finally, public policy could influence the incentives to improve efficiency. Government regulations and subsidy were included. The analysis was based on a panel data set of 17 European airlines over a period of 1991-1995. The empirical findings confirm the detrimental effects of concentration and subsidy policies. Airlines confronting competition look favorably to alliances and mergers. It was found that state ownership did not provide an impediment for being efficient. In order to remain competitive and efficient European airlines need to maintain service quality.

**Kuosmanen (2002)** modelled blank/missing data entries in Data Envelopment Analysis. When blank data entries are coded (zero for missing outputs and some sufficiently large number for missing inputs), the DEA model automatically excludes the missing data from analysis. This result was extended to weight-restricted DEA models. A disjunctive weight restriction was considered that automatically relaxed the weight restriction in the case of missing values and presented a simple but effective trick to linearize this constraint. The approach was illustrated in a case study wherein international sustainable development indices were prepared. These insights tremendously increased the capabilities of applying DEA in situations where data coverage was insufficient.

**Cherchye & Kuosmanen (2002)** monitored countries’ overall performance in sustainable development (SD). Aggregating vast amounts of empirical data is a challenging task. A meta-index of sustainable development (MISD) was constructed as an unequal weighted average of the underlying indices of sustainable development (ISDs). The benefit-of-doubt weighting principle was used which allowed countries to accord higher rates to those SD dimensions in which they performed relatively well. However ‘a priori restrictions’ regarding the acceptable domain of ISD weight values was imposed which constituted a new innovation. These weights bounds reflected the relative importance of different ISDs and ISD categories and it also put normative limits on the variation of weights across countries. The 14 existing aggregate indices for sustainable
development were combined. Full data of 14 output measures were available for 15 countries. Therefore, to increase sample size, countries with a minimum of 6 ISDs were selected pushing up the sample size to 154. Blank entries were replaced by zeros and a simple modification of weight bounds proposed by (Kuosmanen, 2002) was made to circumvent the problem of missing/zero entries in the data matrix. The results identified 6 benchmark countries (three high-income countries and three middle-income countries) and a number of seriously under-performing countries. The diffusion of best practices and policies from the benchmark countries to the less developed world was facilitated by the study. Systematic international comparisons were catalyzed.

Grigorian & Manole (2002) studied the determinants of commercial bank performance in transition economies of Eastern Europe and former Soviet Union. The objective of the paper was to calculate an appropriate measure of commercial bank efficiency in a multiple input/output framework and evaluate the effects of policy framework on the performance of commercial banks as measured by these efficiency indicators. The study estimated the efficiency of banks by using a variable return to scale DEA model. The fact that banks face non-constant returns to scale has been documented empirically. Comprehensive financial data, obtained from data set compiled by BankScope, on a large number of banks from 17 transition economies for 1995-1998 was used. The classification of inputs and outputs was based on their perceived value-added. Three inputs namely, personnel and management, computer hardware and premises and leveraged funds were defined. Two sets of outputs i) revenues, net loans and liquid assets, and ii) deposits, net loans and liquid assets were used for computations. The efficiency indicator constructed based on the first set of outputs (DEA1) placed emphasis on profit generation and the second set of outputs (DEA2) stressed on service provision as a goal. The results of efficiency showed that the countries which produced the best outcome in terms of revenue-based index (i.e. DEA1) are Czech Republic (1995 and again in 1998), Slovak Republic (1996) and Croatia (1997). The list of service-based index (i.e. DEA2) winners consist of Czech Republic (1995), Slovenia (1996 and again in 1998) and Latvia (1997). The differences in efficiency between financial institutions and countries were explained by a variety of macroeconomic, prudential and institutional variables. Post DEA, the results of censored Tobit regression suggest that (1) foreign
Review of Literature

ownership with controlling power and enterprise restructuring enhance commercial bank efficiency, (2) the effects of prudential tightening on the efficiency of banks vary across different prudential norms, and (3) consolidation is likely to improve efficiency of banking operations. Overall, the results confirm the usefulness of DEA for transition-related applications and shed some light on the question of the optimal architecture of a banking system.

Portela & Thanassoulis (2003) studied the performance of the branches of a Portuguese bank. It helped the bank to set targets for the branches on such variables as growth in the numbers of clients, growth in funds deposited and as on. These variables could take positive and negative values but traditional DEA models, with a few exceptions, are restricted to use non-negative data. Based on the directional distance function approach, range directional models were developed to handle unrestricted data in a DEA framework. The use of these models were illustrated and the operational efficiency of a set of Portuguese bank branches found. Portela’s range directional measures represent an interesting contribution to the DEA efficiency measurement in case of negative data especially under assumption of constant returns to scale.

Reichmann (2004) analyzed the technical efficiency of 118 randomly selected university libraries from German-speaking countries (Austria, Germany and Switzerland) and English-speaking countries (the United States, Australia and Canada) using data envelopment analysis (DEA). DEA efficiency scores were calculated using library staff, measured in full-time equivalents and book materials held, as inputs, and the number of serial subscriptions, total circulations, regular opening hours per week and book materials added, as outputs. Among the 118 university libraries analyzed 10 were rated fully efficient. However, comparing group-specific efficiency scores, there were no significant differences between libraries from English-speaking countries and German-speaking countries or between small and large university libraries.

Lin & Tseng (2005) measured the operating efficiencies of 27 international container ports from 1999 to 2002 by applying both SFA and DEA models with three inputs, namely, number of containers gantry cranes, quay length and number of stevedoring equipments and a single output of container throughput. The port data were
mainly collected from ‘Containerisation International Yearbook’ (various issues) and the annual statistical data of various port authorities from 1999-2002. The results showed that the total average operating efficiency scores are \( SFA_{TR} (0.8217) > SFA_{CD} (0.7979) > DEA_{BCC} (0.7075) > DEA_{CCR} (0.6150) \) and Hong Kong port demonstrates the best performance in each model. The paper also examined the correlations between operating efficiencies and three factors, that is, location of the port (Asian vs non-Asian), administrative structure of port (corporate-owned vs public-owned) and national economic growth rate (above-average vs below-average). The results show that operating efficiencies are not significantly different with both location of the port and administrative structure of the port. However, the DEA model shows significant difference with national economic growth rate.

Saranga & Phani (2009) studied the survival and growth of the firms in the Indian pharmaceutical industry for the years 1992-2002. A sample of 44 listed companies were examined using data envelopment analysis (DEA) to determine the best practices, if any, in the industry. The constant returns to scale (CCR), variables returns to scale (BCC) and assurance region (AR) models of data envelopment were used. The DEA results were analyzed along with compounded annual growth rate (CAGR) of the firms to study if internal efficiencies and growth rates were related in the Indian pharmaceutical industry. The major cost elements which contributed 70% of operating income of the pharmaceutical firm in India were chosen as inputs for the application of DEA. The cost of production and selling, cost of material and cost of manpower were the three inputs. The profit margin, net sales and exports were taken as the three outputs. It was concluded that there is a direct relationship between the internal efficiencies and higher growth rates, except in the case of Cipla, Nicholas, Piramal and Wockhardt. It was further suggested that management must not neglect or reduce the focus of internal efficiencies.

Portela, Camanho & Borges (2011) described the performance assessment of Portuguese secondary schools using data envelopment analysis (DEA). Schools were assessed from two perspectives, a society perspective and an educational authorities perspective. Different specifications of the input set were used to evaluate schools from these two perspectives. The DEA model allowed schools to freely choose the weights
assigned to each of the factors considered in the assessment, which reinforced the confidence reposed, to identify inefficient schools. The results of the study from both perspectives showed high efficiency scores. This must not lead us to interpret that Portugese schools are very efficient. Instead, the schools are just homogenous in terms of efficiency. It was also found that the efficiency scores from the authorities perspective were higher.

Nigam et al. (2012) measured the productivity performance of India’s leading telecommunication operators in terms of marketability and profitability. The non-parametric DEA approach was applied to measure relative efficiency and input slacks (i.e. redundancies and unproductive inputs used in production) in the Indian telecom sector. The CCR envelopment DEA model was used to study overall efficiency and BCC envelopment DEA model estimated technical efficiency. Empirical results indicated that none of the telecoms with high valuations exhibited greater efficiency. The wireless operators were more efficient than full service telecoms. It was further suggested that firms could improve scale-efficiency through acquisitions. Nevertheless, pure technical efficiency could dip in the short-run due to integration of resources of two existing units.

To conclude, the extensive review of literature pertaining to performance evaluation and benchmarking of the industry enabled us to carry out the present research on the structure, performance and competitiveness of the Indian IT industry.