Chapter III

SOFTWARE INDUSTRY – A PROFILE

3.1 Introduction

During the last two decades, the Indian Information Technology sector has advanced to the status of a vital industrial sector of international significance and India has built up a reputation that it is one of the world’s strongest software nations. The major contributor to India’s software success has been the software services sector.

Using a highly educated workforce with excellent English language competence as the major input with relatively little capital, Indian firms could satisfy the foreign clientele (mainly US and other industrialized countries in Western Europe) with cost effective IT solutions. Driving the sector’s strong performance is more diversified geographic market exposure and continued expansion of the service portfolio, leading to steady growth in scale by Indian-origin service providers as well as Multinational Corporations (MNCs), having operations in India. Sustained growth amongst indigenous players is being complemented by a continued flow of MNC investments – reinforcing India’s growing role in the new world technology order.

Now India continues to be the ‘nerve-centre’ for global sourcing with over 2/3rd of the Fortune 500 and a majority of the Global 2000 firms leveraging global service delivery – now sourcing from India. India based delivery continues to grow, driven by local firms reporting steady growth in large contract. While India’s own Infosys, Tata Consultancy Services (TCS), Wipro, and Satyam are growing into the role of “global players”, world’s leading players are entering India in a big way. All major names such as Microsoft, Oracle, Sun Microsystems, Dell, IBM and SAP maintain a significant presence in India.
India offers a unique combination of attributes that has established it as the preferred off shore destination for IT-BPO. A large and growing talent pool, Sustained cost competitiveness, Keen emphasis on quality and security, Key Business Infrastructure facilities, Enabling Business Policy and Regulatory Environment, Enhanced value delivery are some of the factors. The visibly higher preference for India is driven by its unmatched superiority when measured across a range of parameters that determine the attractiveness of a sourcing location\(^1\).

3.2 Definition of information technology

It can be stated that information technology is one of the most dynamic and frequently changing and evolving technologies. The concept of information technology is complex and therefore in past research several unambiguous definitions have been made in order to define it. In this study the definition given by Nahar is used. “Modern computing with multimedia capability, computing networks and communications technologies; their development, implementation and provision of technical support; and their application for data processing, storage, sharing, and transmission. All information may be in the same place, or different places, within the same time frame or different time frames. The major components of IT are hardware, software, and services”. Companies are increasingly utilizing information technology in their efforts to internationalize in order to maintain competitiveness in the marketplace\(^2\).

3.3 Definition of software

Software is “A generic term for those components of a computer system that are intangible rather than physical. It is most commonly used to refer to the programs executed by a computer system as distinct from the physical hardware of that
computer system, and to encompass both symbolic and executable forms for such programs³. Researchers indicate that software is a constantly growing industry that requires a relatively low capital investment. It is also an industry that various nations have identified to be an essential factor to their successful participation in the future global economy and world markets⁴.

3.4 Definition of software business

The basic division of software business is to divide it into three main categories: a) Professional software service, b) enterprise solutions, and c) packaged mass market software⁵.

Professional software services are usually highly customized products, expensive and developed in close contact with the actual customer. Building trust, focusing on one domain and in-depth knowledge of the customer are important features in professional software services. In enterprise solutions, the companies are developing enterprise solutions usually for business users and the products are not made in particular to one customer but can be adapted to meet specific needs⁶.

Packaged mass-market software is developed for both business and private users and they are designed for compatibility over several platforms in order to maximize the amount of software product users. Packaged mass-market products are user-distant and they are developed under great a deal of time-to market pressure. Research also indicates that intense marketing efforts and investments are needed in product business. Conducting global software business can be very expensive as a variety of highly specialized tasks need to be performed. It has also been indicated that software businesses tend to be challenging to manage Market share (installed base) is truly vital in product software business⁷. Software businesses in small locations have
the tendency to spread their resources too thinly and success in the international markets typically requires a focused, product-based business model.

3.5 Software industry

Software industry produces software and related services and it is one of the most important parts of information technology. The major segments of software industry are the following: (a) standardized software products, (b) customized software products / services, (c) In-house software development, and (d) embedded software.

Software industry is a growing field, and one that requires relatively low capital investment. It is also an industry that a number of nations have identified as essential to their successful participation in the future global economy.

The demand for the products of the information processing industry – hardware, software, and services- has shown considerable growth globally. The software industry in particular has been noticed to boom.

3.6 Global software industry

“Global software industry refers to the worldwide software production activities such as designing, programming, testing, maintenance, documentation, and selling of software products and related services”.

Internationalization could be explained as following: “A firm’s engagement in a specific foreign market develops according to an establishment chain, i.e. at the start no export activities are performed in the market, the export takes place via independent representatives, later through a sales subsidiary, and, eventually manufacturing may flow.”
Many countries are in the process of a radical push to send their key software processes offshore, and critical centers of software R&D are growing outside the traditional centers. Previous research also indicates that finally, the marketplace is responding to the increased demand for IT labour through the construction of new commercial mechanism\textsuperscript{12}.

3.7 Software Industry and Human Capital

As any other industry, software industry requires the presence of sufficient supply of human resources for progress\textsuperscript{13}. Yet, “Software is different from the traditional manufacturing industries in many respects, especially in terms of the relatively greater importance of human capital relative to physical inputs”\textsuperscript{14}. Investment in recruiting and training human capital plays in minimizing the difficulties related to the non-technical dimension\textsuperscript{15}. The intellectual capital (human capital, structural capital, and relational capital) in the Egyptian software firms and acknowledged the critical role of human capital in software industry development\textsuperscript{16}. It is also acknowledged the importance of human capital and human capital management in software industry and investigated the different roles of human resources in software development\textsuperscript{17}. In fact, weak supply and high-costs of human capital may have serious Implications on the success of software industry\textsuperscript{18}.

Thus, it was no wonder that software development became global and distributed industry that seeks low cost skilled human and sufficient in any country. Consequently, the advantages of human capital mobility in software industry development and the role of international human capital in the development of software industry. Human capital had always attracted transnational corporations (TNC) investment in software industry which later leads to a positive effect on triggering externalities (spillovers) on local community\textsuperscript{19}. 
However, competitiveness of high-tech industries such as software industry need more than the existence of large pool of human capital, other factors such as local policy, internationalization and technology infrastructure define the development these industries. Different models were studied throughout the literature that investigated the relation between these factors, human capital and software industry. Five usable success dimensions for software industry namely: 1) Demand, 2) National vision and strategy, 3) International linkages, 4) Software industry characteristics, 5) Domestic input factors and infrastructure (include human capital, telecommunications technology, and access to finance). Another comprehensive work was compared and analyzed a number of models and stressed the importance of human capital in most of them.

In summary, all models used to explain the software industry growth agreed on the critical role of human capital in explaining the development and growth of software industry.

3.8 Indian software Industry

Software exports in India started around 1974 when Tata Consultancy Services was established. Before that, Indian companies imported hardware from companies like IBM and since software was bundled with hardware there was no market for software. The Indian domestic market lacked computerization and mostly involved in-house development, so IT companies started providing services in the foreign market.

In the mid-80s the Indian government changed policies to support domestic companies and encouraged export-oriented foreign investment. In 1991, the Indian government faced a financial crisis that was a result of increasing oil prices because of
the Gulf War. This resulted in a liberal government policy and helped the IT industry to grow. This also helped develop the software export industry which increased at a steady rate of 40% till 2000\textsuperscript{25}.

To attract foreign investment and development of new organizations the Indian government set up a Special Economic Zone (SEZ) policy in April 2000. This policy helped establish Special Economic Zones throughout the country and this in turn helped in development of infrastructure facilities, creation of employment and promotion of export of IT services.

Although it started in 1974, the Indian IT industry has grown to $60 billion in revenues in 2008\textsuperscript{26}.

3.9 Reasons for growth of software industry in India

3.9.1 Government initiative and policies

The Indian government has helped development of the Indian IT industry since the 1980s. They relaxed the rules and regulations for exports and foreign investment in India, thus helping in development of software exports.

After 1991, India changed a lot of policies to resolve its financial crisis. These reforms included opening of Indian market, free floating exchange rates, and development of a derivative market. All these changes helped Indian software exporters to grow at a rapid pace.

Since 2000, the Indian government started building Special Economic Zones for growth of software industry. These zones included tax relief, cheaper land, and other resources. This helped smaller and midsized firms to grow at better pace and they started contributing to exports.
3.9.2 Sizable work force

India is the second most populated country in the world. Even though 100% of its population is not educated, there has been an inclination towards technical education. Over the last 20 years India has responded well to the technical needs by IT companies by opening up more engineering colleges across the country and providing more technical education at school level.

“While India continues to have enough talented workers to meet most of the needs of its services sector, these workers represent just a small portion of the population” 27

India also gains advantage by having an English speaking technology workforce. Not being able to communicate in English has been a barrier to countries while trying to develop IT services markets.

3.9.3 Low cost labour

India’s main advantage in gaining the outsourcing market is low cost labour. Outsourcing the operations to India results in saving costs up to 50% in labour cost.

The Indian rupee moves in the range of 40 to 50 per US dollar. The reason for low labour cost is low standard of living. Purchasing power parity adjusted gross domestic product, for 2003 was $3,100 for India as compared to $33,000 in the US28. Along with the low standard of living, India has a huge population and with unemployment rate around seven percent, has a big pool of skilled unemployed labours, which is responsible for lower salaries.

3.9.4 Infrastructure

Infrastructure for IT can be classified into two parts. First one is the development of technology parks. The Indian government developed technology parks
to provide all the facilities for development of IT companies. Unlike other parts of India, these parks include high speed internet connection, constant power supply, some exemption from taxes on software, world class building facilities, etc\textsuperscript{29}.

The second level of infrastructure deals with improvement of telecommunication channels, improvement of highways, and the addition of engineering colleges and technical institutes. This has indirectly helped the growth of the IT industry in India\textsuperscript{30}.

3.9.5 Export based growth industry

The Indian IT industry thrives on software exports mainly because of two reasons. The first reason is because Indian software consumers market is not yet mature. Currently, IT requirements for Indian companies are limited and they can be served with pre-packaged software. The Indian IT industry is mainly focused on software services and solutions rather than development of software packages. The only services required by Indian consumers are installation, testing, and customization of packaged software solutions. Most of the non-IT companies in India rely on in-house software services because it is cheaper to maintain a software department than to outsource it to other IT companies. The second reason is because the Indian IT market was not very profitable as compared to foreign trade.

3.10 Location Selection of Indian software Industry

The software industry in India has been concentrated in six to seven cities such as Bangalore, Hyderabad, Chennai, Mumbai Delhi and Pune. Well-researched reasons to explain why these locations have become fertile centers have not been propounded. Many centers do not necessarily have the best infrastructure. The one reason often suggested is the availability of a large pool of locally trained manpower as the
distribution of engineering colleges closely mirrors the distribution of the software industry.

The other significant reason may be the attractiveness of these locations for young and upwardly mobile professionals. Most have a strong cosmopolitan character. The importance of a lower cost of living and favourable climate are important reasons for choosing a location lending support to this argument. For example, Bangalore perhaps boasts of the best education system in India and, therefore, is very attractive as a place for educational professionals\(^3\).

Presence of progressive chief ministers and special state government benefits to attract firms may explain the growth of the Hyderabad center but other locations thrived without such political support.

Because of the high degree of professionalism in most exporting companies there is consistency in the quality of experienced manpower that sometimes moves laterally from one company to the other. Other than this movement, there is not enough evidence of horizontal linkages between IT firms located in the clusters.

Even though five to six centers account for more than 90 percent software exports the typical clustering effect associated with Silicon Valley does not seem to exist in these centers. Perhaps a lack of informal knowledge exchange exists because many companies view other companies as close competitors. Most Indian companies operate in a narrow market space such as in the U.S. market in 2–3 verticals which essentially account for just five percent of the total global outsourced market. Some researchers have corroborated the absence of these linkages in the domestic market and found very little evidence of horizontal interaction in a case where there were four Indian sub contractors in Bangalore working for the same multinational\(^3\).
3.11 The role of the industry organization

The National Association of Service and Software Companies (NASSCOM), India's software industry association, was founded in 1988 and has been a vocal and potent force in lobbying for policy reforms, including rules limiting access to capital markets, issuance of stock options, easing rules on foreign currency transactions, and improving telecom infrastructure.

NASSCOM played a significant role in establishing a brand image for India in the global software services markets by participating in global trade fairs and events and organizing learning events in India that feature prominent experts from major markets. Through its annual reports, NASSCOM has become the most reliable source of data and information about the Indian software industry. NASSCOM activities were influenced by the dominant software players, who share a great commonality of interest in terms of policy recommendations and the Indian brand. NASSCOM also had a very dynamic leader (in Dewang Mehta) whose contribution was widely acknowledged by Indian media.

NASSCOM's membership grew from 38 members in 1988 to over 1000 firms in 2005. It was most effective in policy concerns and brand promotion abroad. NASSCOM was less effective in representing small and medium scale enterprises or domestic rather than export firms.

3.12 Impact of the industry on the Indian economy

The success of the Indian software industry has had wide-ranging effects across the Indian economy. Policy changes to enhance exports are facilitating rapid development of a domestic IT market, offering efficiency gains through adoption of information technologies. In sharp contrast to even a decade ago, Indian business,
government, and consumers have ready access to the newest software products and imported hardware.

The very high standards of management practiced in Indian IT firms and the tremendous employment opportunities offered by the industry have had significant effects on the confidence, aspirations, and work ethic of young professionals in India. The leading software firms have pioneered a movement to modernize Indian management practices, adopting practices of creative organizations with less hierarchical structures and strong work ethics. In order to comply with international norms to participate in international capital markets, IT firms have set new standards in accounting and corporate governance. They have offered unprecedented high-paying employment opportunities for the young and educated labour force, particularly for women professionals.

3.13 Quality Aspects of Indian Software Industry

In their quest to climb the value chain, India's software firms ensured product quality and reliability by adopting internationally recognized standardized work processes. An increasing number of firms have met international certification requirements for key quality standards. For many, this was an exercise in brand building, but the processes and procedures put in place left their hallmark on the quality of software products and services.

Firms seek certification from various sources, beginning with quality management practices that meet ISO 9000 standards to ensure consistent and orderly execution of orders. The next stage focuses on software engineering and certification under the CMM framework of the Software Engineering Institute (SEI) at increasing levels of process maturity. Another stage focuses on aligning internal practices with the
People Capability Maturity Model (CMM), which is a framework to guide attracting, motivating, and retaining a talented technical staff. The Six Sigma methodology assures “end-to-end” quality across all company operations and focuses on improved customer satisfaction by reducing defects, with a target of virtually defect-free processes and products.

Because most Indian software firms are export-oriented and serve clients around the world, meeting globally acceptable frameworks and standards has been critical to validating their credentials to new clients, who often demand that vendors adopt ISO and CMM standards.

The reasons for the success of the quality improvements can be grouped in three categories – people based, business related, and management related. The Indian software industry primarily delivers services, which globally has embraced software process improvement (SPI) more than those who deliver products. As Indian companies serve worldwide clients who demand that their vendors adopt standards such as ISO and CMM, companies were motivated to certify their credentials and used these frameworks to also deliver real software process improvement. As companies moved to an offshore model, SPI became a necessity to succeed. Managing subcontracted work typically requires monitoring structures to contain risk. This imposes a degree of formality at the interface between the users and developers – something that is generally hard to achieve with in-house development.

Most of the facilitating factors are based in more general and societal context. Such factors are hard to emulate once the context changes. Government had little role to play in this movement. India does not have centers along the lines of the U.S. or European Software Engineering Institutes. The Ministry of Information Technology in India did bring in the world’s best Software Testing and Assessment of Software
Maturity through licensing arrangements with Software Engineering Institute at Carnegie Mellon University. Under this agreement, the Indian Standardization, Testing, and Quality Certification (STQC) Directorate of the Ministry of Information Technology undertook the job of Certification, Testing and Training of Trainers and assessors in India.

The increasing importance of outsourced IT services from developed countries prompted many clients to voice concerns about data protection practices of service providers. Issues of data confidentiality, integrity and availability have come to fore. The latest EU data protection laws are designed to ensure that personal data of EU citizens is not sent to a country that has less stringent legal protection. Clients are also demanding adherence to security standards to ensure information security.

The Government of India and NASSCOM are working closely to respond to these concerns. The government introduced clauses in its IT Act of 2000 — covering privacy, digital signatures, and cyber crime— to meet EU requirements. More generally, the government strengthened software testing and assessment capabilities in India, in association with some of the leading organizations internationally. The Ministry of Information Technology set up the STQC directorate to train assessors and implement security standards. An Information Security Technology Development Council has also been set up to promote research in the area of information security.

### 3.14 Future of Indian Software Industry

India compared to its competitors, ranks high on several critical parameters, including level of government support, strong track record of quality and delivery, early-mover advantage of brand recognition, quality of labour pool, English language skills, project management skills, strong focus on processes, and a favourable time zone
difference with the United States that permits 24/7 internal operations. Some of the weaknesses that persist are slow growth in the domestic market and a lack of innovation and product orientation in the bulk of small and medium sized companies. Infrastructure needs improvement in many areas such as roads, electricity, venture capital and airports. Markets continue to be concentrated in North America and are therefore subject to nontariff barriers such as visa denials. There has been some domestic political backlash against outsourcing in the United States and Europe. However, a comparison of India with competitors in software exports on strengths and weaknesses seems to suggest that India’s current position is quite sustainable in the near future.

It is difficult to say whether India’s success can be replicated in other countries. Any country hoping to emulate India’s example would have to define a strategy that matches local capability to global opportunity and discover niches that can be exploited. The niche could very well be in terms of the market to be served on the basis of language competency. Late movers can take advantage of the demonstrated success of the offshore model and how it works. There is only one necessary condition, which is the existence of high quality, trainable manpower and strong entrepreneurial and managerial talent. If countries cannot wait for a high quality technical education system, it may still be possible to mount focused training and certification programs in targeted niche areas. This would of course require a foundation of a good university education system that is producing easily trainable manpower. Key infrastructure for offshore services such as telecom could be created selectively through technology parks. Policy support and incentives can also be provided selectively. Since trust is a key issue in offshore work, the country's Diaspora and intermediaries can play a critical role in the beginning.
3.15 Key factors that explain success of Indian software industry

- Software industry can be built entirely on human capital. Requires limited infrastructure and upfront investment. Has good cash flows and is highly profitable.
- India had an early-mover advantage: repeated positive experience built trust in outsourcing and validated the Indian brand.
- Role of human capital, including software engineers, project managers and corporate leaders.
- Early investments in engineering education and privatization of education created a large talent pool.
- Body-shopping exposed a large population to new ways of working.
- Professionally trained entrepreneurs.
- Vigorous efforts at assimilating new technology and good management practices helped companies offer competitive costs for high quality and delivery performance.
- Selective support to industry in an otherwise constraining environment by a few enlightened bureaucrats and the role of NASSCOM in influencing policy.
- Lack of effective implementation of restrictive policies allowed market forces a significant play in the early phase. The economy was liberalized in later years.
- Highly entrepreneurial IT training and private education industry. Responded quickly to fill skill gaps and opportunities. Positive government policies and lack of regulation meant few barriers.
- Large population created competition for engineering seats and jobs. Software industry faced no internal competition for technical talent. Competition from MNCs came when indigenous firms were prepared.
References:


