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Innovation in Software Services Sector in India: A Historical Perspective

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ABSTRACT: Indian software industry's rapid growth during the decade of 1990s and the decade following the dawn of the new millennium had attracted the attention of academics and corporations alike. While the interest of corporations in India was manifested by the increasing number of software units that were set up by several domestic and transnational corporations in this country, the academics on the other hand, have been studying the success of the software industry from various perspectives. The evolution of the industry from a position of obscurity in the 1980s to its pre-eminent role in the global software market today has been a remarkable transformation. This paper is an attempt to study the innovations in software services by Indian firms along their growth trajectory that have enabled this transformation.

KEYWORDS: Indian Software Industry, Software Services, Software Sector, Innovation.

I. INTRODUCTION

From a minuscule size in the 1980s, India's software industry has transformed itself into one of the most important sectors of Indian economy with an annual turnover of \$129 billion in 2015[1]. Being predominantly export oriented, the industry is considered inherently innovative and has contributed immensely to the nation's foreign exchange reserves. It has also resulted in 'spill over' benefits and other long term effects like : improvement in perception and attitude of people towards enterprise and entrepreneurs who play an important role in innovation[2]; accumulation of technological capability in software design and development, which is comparable to the best in the world; and emergence of India as a major hardware design and software & services destination in the world which has prompted many top global companies to set up their Research & Development (R&D) and software development centres in India. So, what were the innovations in software services that enabled India to become a prominent exporter? What was the trajectory of Indian software firms as they moved up the 'value chain'? In this paper we try to explore these questions from the historical perspective.

II. LITERATURE REVIEW

Much of the extant literature on Indian software industry deliberates on the nature of success of the industry. The earliest such studies in its nascent years were by Schware, 1992; Dedrick & Kraemer, 1993; Arora, Arunachalam, Asundi, & Fernandes, 1999; Arora & Athreye, 2001; Tschang, 2001 among others [[3];[4];[4];[5];[6];[7]]. They have all deliberated on India's comparative advantage in software. Some have discussed various coincidental causes for the success of the Indian IT Industry, for example, combination of abundant human resource endowments, linkages to the main export market, convenient time zone vis-a-vis the main export market in the US, and the basic facilitation of infrastructure for communications and trading by the government. Schware, 1992; Parthasarathi & Joseph, 2002; and Sarma & Krishna, 2010 have deliberated at length on different aspects of export orientation of the software industry [[3];[8];[9]]. Arora & Asundi, 1999 have studied the industry from the perspective of quality certification and its forbearance on the firms' growth [10]. However, a comprehensive study of the range of innovations in delivery of software services along its evolutionary trajectory remains largely unexplored. The current proposal is to explore this aspect of the industry along its growth path.

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III. METHODOLOGY

Focus Group Discussion was one of the several tools adopted for the study. It is a form of qualitative research tool that is used in various disciplines including Business studies, Social Sciences, Library & Information Sciences and in Engineering for evaluating usability of products and solutions [[11];[12]]. Typically, Focus Group Discussion involves congregation of people from similar backgrounds to discuss a specific area of interest.

For the purpose of this study, Focus Group Discussion of software industry professionals was conducted to discuss the innovation trends in the software services industry. This was supplemented by inputs from industry seminars and survey of software industry literature from the companies and from other secondary sources. The results of the study are outlined in the next section.

IV. INNOVATION IN SOFTWARE SERVICES BY INDIAN SOFTWARE FIRMS

Since its inception, the software industry has been taking various innovative measures for remaining competitive and profitable in the global software industry. The various steps taken by the firms of this industry to move up the value chain along its evolutionary path are discussed below.

A) Shift from 'Body shopping' to value added services

The initial push for the industry's establishment was given by the government's policy of export obligations. Firms were permitted to bring in computers only if they consented to meet the export commitments[13]. Further, the government issued threats of reallocation of computers if the organizations neglected to meet their export commitments. The blend of the government pressure and the software firms' survival impulses brought about 'body shopping' as a method for meeting the export obligations. 'Body shopping' is a pejorative term used to refer to the dispatch of Indian software developers to a foreign destination on contractual basis to write programming code for a foreign client.

Though the software industry's initial growth was on the wage differential between India and the advanced nations where the required software workers were sent, Indian companies have been persistently trying to move up the value chain by providing value added services. Over a period of time, they have been able to transform themselves from suppliers of labour to suppliers of software solutions. Indian companies have been brisk in adapting new programming methods by quickly diffusing those techniques among the employees of the organization. Some prominent examples include: the absorption of Unix technology during initial phase of growth; the development of solutions for the Y2k problem; development of Internet and e-trade technologies; and adoption of some of the new Microsoft advances, for example, .NET technology.

B) Custom application development and application outsourcing

In their quest for increasing profitability and providing better services to the client, Indian software firms have climbed from body shopping to custom application development and application outsourcing.

Custom software is developed for a single customer to accommodate that customer's particular preferences and expectations especially when such software is not available on the market or, the available packaged solutions and software aren't sufficient or flexible enough for the specific needs of the enterprise[14]. Generally, large companies use custom software for critical functions, including content management, inventory management, customer management, human resource management, or otherwise to fill the gaps present in the existing software packages. Custom software development is often considered expensive compared to off-the-shelf solutions or products.

While custom application development is about giving customized solutions for the customers' problems, Application outsourcing includes developing either full products or some modules for MNCs in close coordination with them. The outsourcing arrangement could be for a wide variety of application services including new development, legacy systems maintenance, offshore programming, and management of packaged applications[15]. These efforts have extensively improved their technological capacities. In 2002-03 revenue earned from these sources was US\$ 4.87 billion[16].

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C) IT Consulting

Indian companies were able to tap the lucrative IT consulting market due to their well established domain knowledge in various fields. Top Indian companies like Wipro, TCS, and Infosys successfully leveraged their brand's reputation to target potential customers. While larger firms acquired boutique consulting firms across the globe, the smaller ones took the joint venture route with consulting firms to penetrate the consultancy market.

IT consulting requires an end-to-end approach for creating solutions. Other than being more profitable, IT consulting has the additional advantage of drawing in contractual works at the lower level of the value chain.

D) Enterprise Application Integration

Lately, Indian organizations have forayed into the more profitable business of Enterprise Application Integration (EAI) requiring higher technological aptitudes for integrating the clients' current applications for enabling better sharing of information and data, controlling expenses, and guaranteeing better rate of return on investments.

Enterprise application integration is an integration framework comprising of a collection of technologies and services which form a middleware to enable integration of systems and applications across the enterprise. It enables unrestricted sharing of data and business processes throughout the networked applications or data sources in an organization. For example, EAI may involve interlinking of Legacy software programs developed for inventory control, human resources, sales automation and database management that were designed to run independently, with no interaction between the systems[17]. Thus, EAI helps businesses to streamline processes and keep all the custom built technology of the past that were designed for a specific need and were often proprietary systems as interconnected elements of the enterprise.

Four major categories of EAI¹ are: (1) Database integration: enabling databases to share information and make copies of the information as required. (2) Application integration: business related processes and data between two or more applications are shared in the enterprise. (3) Data warehousing: data is retrieved from disparate data sources to create a central repository for analysis. (4) Common virtual system: considered the most sophisticated form of EAI; it involves integration of all components of enterprise computing so that they appear as a unified application.

EAI solutions were provided by Indian firms at six different levels: platform integration, data integration, component integration, application integration, process integration, and business-to-business (B2B) integration[16]. EAI solutions empower organizations to exchange data over different applications, and enable simple and dependable access of corporate data.

For providing EAI solutions, Indian companies have upgraded technologically and built significant domain knowledge in several fields. Most software firms have built capabilities to serve industries of different sectors, for example, manufacturing, oil and gas, retailing, insurance, and telecom. These companies have formed groups of specialists with deep knowledge of operational aspects of different industrial sectors to help the organization develop software solutions in different industrial domains.

E) Package Implementation and Support

Indian software companies have also gained significant expertise in Package Implementation and Support services. This is the market that accounts for around 15 percent of the aggregate worldwide IT spending. In 2002-03, the industry grew 17 percent to touch US\$ 350 million in this section[16]. To be successful in this segment, firms need to build domain knowledge and expertise in different industry verticals and win against stiff competition from large MNCs operating in this space.

Other than the above-mentioned measures of technological and business innovations, one area where Indian firms have shown significant learning capacity is in building quality management systems.

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F) Quality Management Systems

Starting with the ISO 9000 certifications, which guaranteed a reliable and efficient execution of client engagements and gave a structure for measurable improvement, Indian software companies have graduated to software engineering related CMM system for evaluation and affirmation. The significance of quality management system for Indian firms can be gauged from the fact that India has been among the countries with the largest number of SEI CMM Level 5² organizations on the planet. By December 2003, India had around 65 organizations at SEI CMM Level 5 evaluation. The quality consciousness of Indian software and ITES-BPO³ industry can be measured from the fact that officially 275 Indian software and ITES-BPO organizations had gained quality confirmation and around 80 more organizations were in pipeline in 2003. Not content at having accomplished the highest level of affirmation for software engineering, numerous Indian software organizations had set out for the next level of quality consciousness. The primary motive was to establish procedures, metrics and a system for improvement in all areas including operations pertaining to sales, billing and collection, personnel administration, and after sales support. Generally, this was achieved by organizations aligning their internal practices to the People CMM framework and by the utilization of the Six Sigma procedure for increasing consistency and guaranteeing "end-to-end" quality in all company operations.

In spite of the fact that a few critics have questioned the potential advantages of adopting quality procedures, there is little uncertainty that most Indian firms, especially the bigger organizations have internalised quality orientation in their operations. Their capacity to persistently upgrade their procedures has been rewarded by their customers with large contracts that have resulted in a flourishing business for them. Undoubtedly, quality certifications and appraisals have been a powerful factor in winning these contracts.

G) Global Delivery Model

In their endeavour to retain their competitive advantage, Indian organizations have been looking for innovative methods for delivering software and services economically. Their efforts have brought about another delivery model in which a major segment of the software development is completed 'offshore' and only a minor part of the work is executed at the remotely located customer's site. NASSCOM estimated that offshore incomes as an extent of total revenues had expanded from almost 35 percent in 1999-00 to 56 percent in 2002-03. The extent of onsite incomes during the same time period had diminished from 57 percent to almost 43 percent. The trend has continued ever since.

The Global Delivery Model includes several components for delivering software and services. NASSCOM's classification included four components.

- *One Onshore* (same country as client) location for delivering services like account management, consulting assistance by domain experts, high level design, emergency bug fixes, and assessment/estimates.
- *On-site* (client site) for project management, requirement analysis, prototyping, user interface design, usability testing, integration testing, acceptance testing, implementation, user training, and warranty maintenance.
- *Nearshore* (country near to client country) for high level design, quick turnaround development, emergency bug fixes, interactive development, prime-time support, testing, risk diversification for onshore/offshore tasks, on line applications management.
- *Offshore* (India) for project management, detailed design, coding, unit testing, preliminary usability testing, documentation, bug fixing, warranty maintenance, and ongoing maintenance.

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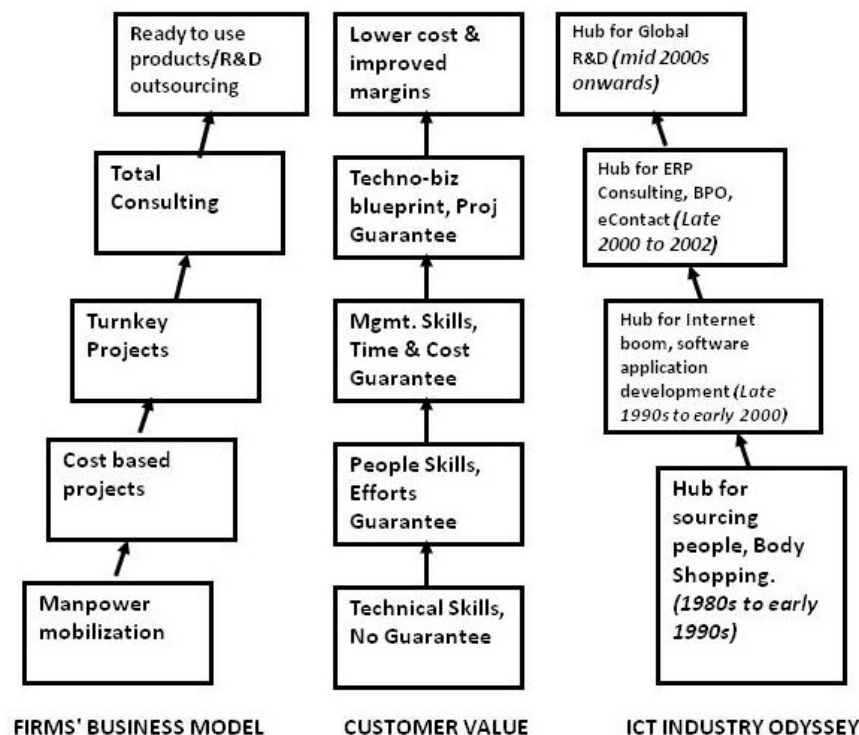
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H) Evolutionary Trajectory of the Indian Software Industry

In this segment different phases of growth of the software industry and the value additions made to the clients in each of these stages has been delineated. It also depicts the focus areas of the industry in general at different times over the last couple of decades. A diagrammatic representation of evolution of software industry is made in Figure 1.

Figure 1 Software Services trends

Trajectory of the Indian Software Industry (Moving up the Value Chain).



During this early phase in the 1980s, Indian software firms' primary business model was mobilization of talented software workers. In Industry jargon this was derisively referred as 'Body shopping'. Generally, it involved supplying talented software workers to Client Companies to be utilized by them according to their specific needs. Then came a phase when Indian firms began taking up 'cost based projects' from clients. It meant that if an expected task of a customer required x number of individuals to work for y number of hours it was given. Although, technically, this also amounted to 'body shopping', unlike in previous stage of 'manpower mobilization' where the skills offered were purely technical with no other guarantee, in this case, the Indian firms offered people skills in addition to technical skills and a guarantee of efforts from them, i.e., x number of people working for y number of hours.

In the following stage, Indian firms further climbed up the value chain and started offering 'turnkey' solutions by taking up 'Turnkey Projects'. In this stage, the customer was offered management skills and time and cost guarantee for the projects undertaken. As the industry matured, Indian firms moved further up the value chain to provide 'Total Consulting' solutions. The distinction between the 'Turnkey Projects' stage and the 'Total Consulting' stage was that while in the previous stage, Indian firms were allocated tasks and were required to complete it as per the advice of the

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client, in the later stage; they collaborated with the customer's organisation in diagnosing issues and creating solutions for them. Large software firms like Infosys, TCS, Wipro, et al might be categorized to be at this stage of evolution. The final phase represents recent trends and also projects the future trajectory of the industry. It encapsulates the software firms' move into the arena of devising, developing, and marketing of innovative software products or to outsource Research & Development activity for major software or hardware producers.

Indian software firms adopted different business models at various stages of their evolutionary trajectory. The initial two phases, ie, 'manpower mobilization' and 'cost based projects' can be together categorised as the era when the industry focussed on 'body shopping'. The following phase of 'Turnkey Projects' might be termed as the period when India turned its focus to Internet Software and Application Development. Further, as the software businesses climbed up the value chain to offer IT Consulting, Enterprise Application Integration, and Packaged Software implementation, India turned into a focus area for ERP Consulting and Techno-business consultancy. The corresponding business model of Indian firms in this period may be termed as 'Total Consulting'. Finally, from the evidence of the major software & hardware producers setting up their own R&D centres in India, this phase could be termed as the era when the industry's focus was to offer high value Research & Development services and product development services.

V. CONCLUSION

During the early phase, the industry was engaged with lower level tasks of the waterfall model of software development. Initially, Indian firms stepped into the global software market by supplying software workers for foreign assignments. Gradually, the industry matured as Indian firms internalized quality systems like CMM and ISO and adopted sophisticated modes of software development and delivery from offshore locations. As they augmented their technological capability, Indian firms moved up the 'value chain' to deliver high value software services. Thus, the software industry which had initially commenced business with the derisive practice of 'body shopping' had evolved to deliver high end R&D services and product development services.

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