



The University of Sydney

School of Economics and Political Science

## Working Papers

**Indian Software Industry: Growth Patterns, Constraints  
and Government Initiatives**

**Chandana Chakraborty and Dilip Dutta**

**ECON2002-1  
Discipline of Economics**

**Faculty of Economics and Business**



ISBN 1 86487 488 0  
June 2002

ISSN 1446-3806

**Indian Software Industry: Growth Patterns, Constraints and  
Government Initiatives**

Chandana Chakraborty  
Montclair State University  
and

Dilip Dutta \*  
School of Economics and Political Science  
University of Sydney, Australia

Email: [seps@econ.usyd.edu.au](mailto:seps@econ.usyd.edu.au)

### ABSTRACT

Based on a survey of software-related companies in the major cities of India, this paper provides an analytical framework for examining the organization and size of the Indian software industry. With regard to organization, the extent of foreign participation in the industry and the degree of concentration in the industry have been looked at closely. The size of the industry, on the other hand, has been discussed in the context of the relative significance of its domestic market and export market. Export significance has further been evaluated by taking account of its qualitative composition. Given the current size and organizational structure of the industry, its future outlook together with the opportunities and challenges has also been briefly outlined. Finally, an attention has been drawn to India's recent strategic national policy and initiatives for strengthening its position in the software-driven information technology sector in the world.

\* The authors are thankful to Bala Subramanian , Professor of Management, IIM, Bangalore, India, for his helpful comments on an earlier draft of this paper.

Disclaimer Notice : The responsibility for the opinions expressed in these working papers rests solely with the author(s). The School of Economics and Political Science gives no warranty and accepts no responsibility for the accuracy or the completeness of the material.

CONTENTS	PAGE
1. Introduction	1
2. Organization and Structure of the Industry	3
3. Employment Potential	5
4. Markets for Software Products and Services	6
5. Qualitative Aspects of Software Exports	7
6. Future Opportunities and Challenges	9
7. Government's Recent Policy Initiatives during the 1990s	12
8. Conclusion	16
References	17
Table 1 Industry Organization: Computer Software	19
Table 2 Industry Concentration: Computer Software	19
Table 3 Employment in Core Software Industry of India (thousands of employees)	19
Table 4 Domestic Share of Software Revenue for India, Western Europe, Japan and the U.S.	20
Table 5 India's Computer Software Industry: Sources of Revenue (in percentages)	20
Table 6 Software Export Profiles of India and its Competitors in mid 1990s	20
Table 7 Constraints Encountered by Indian Software Industries	21

## Introduction

Measured by the age of many industries, the computer or information technology (IT) software industry<sup>1</sup> in India is still in its infancy. Yet, its growth and development has caught the attention of the world market so much so that India is now being identified as the major powerhouse for incremental development of computer software. The reason for this attention is not the actual size of the industry but its rapid growth rate during the 1990s and its projected growth rate in first decade of 2000. According to the National Association of Software and Services Companies (NASSCOM), India's quasi-governmental software industry promotion organization, the software industry in India was worth Rs. 243.5 billion or US\$ 5.7 billion in 1999-2000, whereas ten years back its worth was not more than Rs. 3 billion or US\$ 150 million<sup>2</sup>. Although India's domestic software market is burgeoning fast, the most important factor that has driven this progress is the growth of the export market. While still a relatively small share of export market, India's software

---

<sup>1</sup> The term 'IT industry' generally covers development, production and services related to IT products. Hence it contains three basic sectors: software, hardware and services. So, the IT software industry has two components: IT software and service. According to the definitions given in *Information Technology Action Plan-I* (under Recommendation No. 19), *IT Software* means any representation of instructions, data, sound or image, including source code and object code, recorded in a machine readable form, and capable of being manipulated or providing interactivity to a user, by means of an automatic data processing machine falling under heading 'IT products', but does not include 'non-IT products'. *IT service* is defined as any service which results from the use of any IT software over a system of IT products for realizing value addition.

<sup>2</sup> Statistics are obtained from [www.nasscom.org/template/itinindia.htm](http://www.nasscom.org/template/itinindia.htm).

export business is mushrooming and export revenue has been growing at an increasing rate<sup>3</sup>. In terms of Indian rupees, the compound annual growth rate (CAGR) for India's software export revenues over the past five years has, according to NASSCOM's statistics, been as high as 62.3 percent, compared to 46.8 percent of CAGR for its domestic market revenue during the same period. With a modest beginning in 1984-85, software exports have moved up from Rs. 25.2 billion or US\$ 734 million in 1995-96 to Rs. 171.5 billion or US\$ 4 billion in 1999-2000. Furthermore, NASSCOM's survey in 2000 indicates that more than 185 of Fortune 500 companies, i.e., almost two out of every five global giants, outsourced their software requirements to India during 1999-2000.

The combination of events that has fueled the demand for Indian software services in the world market, however, is a complex one. Cost is an obvious, although diminishing factor. As the Indian market, both domestic and export, has boomed, the wage gap between Indian software professionals and their counterparts in the developed countries has started to narrow<sup>4</sup>. Nevertheless, cost advantage remains substantial even today. In addition, worldwide interest in

---

<sup>3</sup> Heeks (1996) provides time series on India's software export earnings for the earlier period of 1980-1995. Recent figures on export earnings are obtained from the National Association of Software and Services Companies (NASSCOM) web-site ([www.nasscom.org](http://www.nasscom.org)), which are 61% in 1994-95, 64% in 1995-96, 55% in 1996-97, 67% in 1997-98, 68% in 1998-99 and 57% in 1999-2000.

<sup>4</sup> As reported in Business Week (February 26, 2001), salaries of Indian programmers, with a monthly average of US\$800, are rising at a rate of 15% per annum.

business process reengineering, the economic imperatives in developed countries of outsourcing, cost-efficient maintenance of existing mainframe systems and continuous development of new software for personal computers (PCs) have played significant roles. Finally, India's comparative advantage in the software industry, generated from its relative abundance of qualified software engineers, coupled with the government's timely national action plan for rapidly improving communications infrastructure has played a key role in creating confidence among buyers of Indian software products and related services. As is evidenced by the rapid growth in their demand, Indian software engineers have carved out a name in the world market for providing an unbeatable combination of quality software at a low cost; Indian software developers offer a cost advantage of 40% to 60% over their American counterpart.<sup>5</sup>

Motivated by its present growth trends and estimated future potential, this paper attempts to provide an analytical framework to examine both the organization and the size of the software industry in India on the one hand, and the role of government in this sector's rapid growth on the other hand. Organizational structure and size are key factors determining the strength of an industry. Both these factors have been given close attention in this paper. Organization is discussed in terms of the industry's legal structure and degree of concentration. The size of the industry has been analyzed by examining

---

<sup>5</sup> Vijayan (1996) offers a careful analysis of the advantages that Indian software developers provide to U.S. companies.

the relative significance of its domestic and export markets. In addition, the industry's strength in generating employment and its impact on national economy has also been looked into.

Analysis relating to the industry's structure and organization in this paper is based on the reports of a preliminary survey conducted among a wide group of software related companies in India. More than 200 questionnaires were sent to such companies in the major cities of India including Bangalore, Madras, Hyderabad, Pune, Mumbai (Bombay) and Calcutta. Only 35% of the questionnaires were returned with completed responses, which have been processed to generate data for the present study. The rest of the paper is organized in the following manner. The section that immediately follows describes organization of the Indian software industry and presents some of the salient features of its structure and composition. Section 3 focuses on employment potential of the industry and its impact at the national level. Relative significance of domestic and export markets in defining industry revenue has been given special attention in section 4. Export significance in terms of its qualitative details has been scrutinized in section 5. Section 6 summarizes opportunities expected at the global market and takes a close look at India's ability to utilize those opportunities for creating a sustained flow of revenues in future. Section 7 focuses on the recent national strategic policy and initiatives taken by the Government of India. Finally, based on

---

the current state of the industry, its future opportunities and challenges, a conclusion is provided in section 8.

## **2. Organization and Structure of the Industry**

The basic difficulty of analyzing the computer software industry arises from the complexity of its definition. The industry, by no means, is easily defined. In addition, it is rapidly changing. As a result, there is always scope for disagreement regarding which groups of firms should be included in the industry or how to describe the structure of the industry either at the present time or in the future.

While assessing the size and growth of the Indian software industry, we have followed the definition provided by the standard industrial classification codes (SIC) of the United States Government. Going by the 1987 revised codes, which lists nine industries as parts of computer software industry, we considered the following three groups of firms as defining the "core" software industry or simply the Indian software industry: custom computer programming services; custom designing services and prepackaged software services.<sup>6</sup> In the context of

---

<sup>6</sup> As per the 1987 revision of SIC codes, the basic computer software industry is defined to be composed of the following nine product and service groups: i) Custom Computer Programming Services (SIC 7371); ii) Pre-Packaged Software (SIC 7372); iii) Computer Integrated Systems Design (SIC 7373); iv) Data Processing and Preparation (SIC 7374); v) Information Retrieval

India, where software developers, in general, choose to have their sources of revenue linked to a variety of activities and not just to a specialized line of services, the definition of programming services needs to be broadened to accommodate commonly performed activities. Specifically, the broad definition should include data processing, body shopping and manpower training as part of programming services. Similarly, the category of custom computer designing services needs to be modified to include custom software designing as well as designing of integrated system. Based on these definitions, the organizational structure observed among the sample companies surveyed has been shown in Table 1.

As is apparent from the table, the organizational structure of the computer software industry in India is dominated by private limited companies. Of the total 68 companies observed, 37 identified themselves as private limited companies. The significance of the privately organized companies is visible across the industry groups listed. The majority of the companies in each of the three groups listed are organized as private limited companies. This might be indicative of the influence of liberalization policies being pursued by the Indian government since 1984-85. Despite the popular belief regarding the contribution of the major microelectronics corporations of the West in creating production

---

Services (SIC 7375); vi) Computer Facilities Management (SIC 7376); vii) Computer Rental and Leasing (7377); viii) Computer Maintenance and Repair (SIC 7378); and, ix) Computer Related Services NES (SIC 7379).

facilities in India, subsidiary organizations, as per our sample, define only a smaller proportion of the software industry groups. Only 12 of the 68 respondents reported having a parent organization outside India either in the United Kingdom or in the United States.

Given the relative youth of the Indian software industry, time series data on growth of establishments are difficult to obtain. Most of the companies in our sample report their date of establishment to be between 1992-1995. However, the common belief is that the number of establishments has grown substantially since 1990-91. Be that as it may, the vast majority of the firms in the software industry are small. Only a few claim an asset size larger than Rs. 300 million<sup>7</sup>. Based on the reports of our survey, Table 2 describes concentration of firms in the Indian software industry. As per the sample studied, companies engaged in packaged software services and custom computer programming services account for the major share of the industry assets. Custom designing services account for only 19% of the total assets. Individually, however, almost all the firms are small in terms of their asset size. Of the 68 respondents in our sample, only 11 have assets larger than Rs. 300 million.

---

<sup>7</sup> Interestingly, this resembles the structure of the software industry in Western Europe. The bulk of the software industry in Western Europe is still made up of small, loosely organized firms. Although a few large corporations have gradually emerged in software services, many of them are organized informally and make frequent use of subcontracting. See Mowery, 1996 for detail.

Smaller asset share of the group of custom designing firms explains their negligible contribution to total business revenue. All the custom designing companies together define only 17% of the business revenue; a meager Rs. 2596 million out of a total of approximately Rs. 14 billion. Although the average size of the companies providing programming services is relatively small, they are the largest source of revenue for the aggregate industry; together, these companies define 45% of the total business revenue<sup>8</sup>. Seen from the perspective of single firm revenues, however, only 15 claim revenues in excess of Rs. 500 million.

The industry groups of programming and prepackaged software services do not appear to have significant concentration in the industry. The four largest firms in programming services account for only 32.1% of total business revenue in that group. For prepackaged software services, the four largest firms claim slightly over 39% of the group revenues. Interestingly, companies related to custom designing services appear to be highly concentrated; the four largest firms in this group define 72.3% of the total revenue. However, the high concentration ratio might represent an upward bias due to the limited presence of firms in this group.

---

<sup>8</sup> This is in conformity with our expectations on nature of software activities in developing countries. As explained by Kopetz (1993) contract programming usually appears to be an interesting activity for developing countries. It requires little capital investment, other than state-of-the-art training facilities and access to an international electronic network.

### 3. Employment Potential

The significance and strength of the computer software industry can also be estimated by its contribution to employment growth in India. Once again, in the absence of time series data, the growth rate of employment could not be computed. The actual levels of employment in the three different groups of the industry, together with their share in the total industry employment and national employment, are presented in Table 3.

As is to be expected, the companies related to custom computer programming services, because of their relatively large numbers, define the major source of employment in the software industry. The companies in this group account for more than 47% of total industry employment. An almost equally significant role is played by the companies grouped under packaged software services; together, they define 45.96% of the total industry employment. Companies engaged in custom designing services, with their insignificant presence, provide 6.8% of the total industry employment. Seen from the national standpoint, however, the contributions of each of the three groups of firms appear insignificant. Together, all the groups of the firms define only one hundredth of one percentage of national employment.<sup>9</sup>

---

<sup>9</sup> As estimated by Heeks, 1996, software industry employment in India was just over 0.5 percent of total manufacturing employment in the mid 1990s. However, Heeks considered this estimate to

At a first blush, accounting for only 0.01% of national employment may appear to be an underwhelming achievement for the core computer software industries. The Indian national government, however, lists hundreds of industries in the private sector. Relatively few industries or industry groups are larger than the computer software industries in terms of source of employment. According to the NASSCOM Report 2000, number of software professionals employed in India's IT software and services industry is 410,000 as on 31 December 2000.

#### **4. Markets for Software Products and Services**

As mentioned at the outset, the shortcomings of the domestic market have forced the Indian software companies to seek growth by moving towards the export market. This is in sharp contrast with the pattern of growth observed for the leading software industries in Western Europe, Japan and the United States. For all these three countries, growth in software industry was aided significantly by growth in domestic demand; the latter growth, in turn, was caused by rapid diffusion of low cost microcomputer technology and wider scope of its

---

be biased upward since it masked the high attrition rate observed in almost all the software companies.

application across different economic sectors.<sup>10</sup> The relative significance of the domestic market for software industries in India, Western Europe, Japan and the U.S are reflected in Table 4 which breaks down domestic market share of revenue for each of these countries by product category.

As is apparent from the above table, Western European software industries tend to sell their products and services mainly within the European markets and exhibit very low degree of internationalization. For the U.S. software industries, about three fourth of the revenues are generated in the domestic market. Though not as significant as in the case of Western Europe and the United States, the domestic market in Japan explains more than half of its total software revenues. With a meager share of 17.5%, the domestic market for Indian software industries appears to have a negligible importance.

#### **Export Market Significance**

With lack of significant domestic demand, growth in Indian software industries has been spurred mainly by the growth in export market demand. As is indicated by our survey, the export market is mostly concentrated in the United States and Europe. To capture the differences in market specific demand and their

---

<sup>10</sup> For a comprehensive analysis of the structure of domestic software production and consumption in the United States, Japan, and Western Europe, see Mowery, 1996.

significance in industry revenue, Table 5 provides a breakdown of the sources of industry revenue by categories of industry groups.

As is evident from the above table, almost two thirds of the software revenue for the Indian companies examined in this paper come from servicing the United States market. Going by the categories of industry groups, the United States is the largest source of income for all the three groups in our list. Europe's contribution in the industry revenue, however, is smaller and is less than that of the domestic market; European demand explains only 12.1% of the aggregate revenue reported by the firms. As seen earlier, the domestic market, on the other hand, explains 17.5% of the reported aggregate revenue; almost one fifth of the industry revenue. Interestingly, the highly developed East Asian market seems to be of very little consequence for the firms in the Indian software industry at least up until late 1990's.

The significance of the U.S. market for Indian software exports can partly be explained by the following reasons. First, the United States is by far the world's largest software market defining about half of all software sales in the 1990s. Second, American information technology and financial services companies have moved much faster than their European counterparts to take advantage of offshore activities. Third, the United States has had relatively liberal immigration rules for work or residence than most other developed countries even after the early 1990 changes. Finally, India's own interest in tying up with the American

market cannot be underestimated. A large number of Indian software developers are U.S. trained and so understand the market better than its competitors. Further, there has been a substantial increase in the number of software related collaborations with U.S. firms since the early 1990s. These collaborations offer a way to circumvent the marketing barriers for open market competition by guaranteeing access to export market.

## **5. Qualitative Aspects of Software Exports**

The previous section concerned itself with quantitative estimates of India's impressive software exports. This section draws attention to some of qualitative discontents of Indian software exports by arguing that though impressive in terms of annual percentage of growth, software exports have been poorly diversified with respect to product category, type of contracts, and level of skills.

### **Product Category**

Though it is impressive to have U.S. market as the major source of export earnings for Indian firms, the majority of the sales reflect demand for software services that include custom software work and programming services. Sales of software packages define a negligible percentage of the total sales. Although most of the major software exporters have sold compilers and financial program packages overseas, total sales figures have

remained insignificant. The only exception is Wipro Systems Limited (WSL). With sales figure in tens of thousands, they have been identified as the major seller in the 1990s<sup>11</sup>. Excluding a few successful companies like WSL, the trend of developing and exporting of indigenous software packages has been rather dismal. On the other hand, major reliance on software service exports has caused India competitive disadvantage in the global market where competitors rely much less on export of software services and more on export of software packages. An estimated breakdown of export type for Indian software companies in relation to its competitors are shown in Table 6.

As shown by the above table, India's export profile is skewed compared to that of its close competitors who have been somewhat successful in diversifying their exports. Lack of diversification, thus, makes India vulnerable in the future, when increased competition is expected in the international software market.

#### Nature of Contract: Onsite vs. Offshore Activities

Future vulnerability of Indian software industry is compounded by the fact that much of India's export of software services is actually carried out at the client's site overseas, commonly referred to as 'onsite services', rather than offshore in India. Based on figures from our survey, approximately 70% of export services consisted of onsite work, while only about 30% were of

offshore type. Interestingly, this was even true for software companies located in technology park areas which were constructed to be the bases for offshore work.

The persistence of onsite work as the dominant mode of export earnings can be explained with the followings. First, there is a bias against Indian firms' skills, ability and quality of work in export markets. Clients often reflect a lack of trust for Indian firms' credibility and perceive of a higher degree of risk in sending work out to offshore. In order to reduce the risk, they prefer to retain most of the control over production with themselves by having the work carried out onsite; only the relatively risk-free tasks like coding and testing are, therefore, contracted out. Second, as suggested by Info Tech's survey, the determining factors regarding onsite work are: costs, credentials, efficiency and quality<sup>12</sup>. The growing number of Indian firms working onsite suggests that they tend to score quite high on all these areas. By contrast, for offshore, more popularly known as 'turnkey projects', cost becomes much less of a consideration. The important factors taken into consideration for decision on such projects are managerial skills, quality control and access to technology. The existing perception among clients abroad is that Indian firms tend to score less in those areas.

---

<sup>11</sup> See Heeks, 1996 for further details on sales of software packages.

---

<sup>12</sup> See Info Tech Consulting Inc. (1992) for survey results on India's software services export potential.

Though not as important as the earlier factors, project size is also an important factor guiding foreign firms in their decision over onsite and offshore work. As discussed by other observers and researchers in the literature, a minimum project size of US\$100,000 defines the threshold for foreign firms to consider sending their work out to offshore. As is apparent from our survey, majority of the contracts received by Indian firms falls below this minimum threshold.

Finally, software company managers in India have always been apprehensive about the direction of Government policy changes, at least until recently. Frequent changes in government and in political ideologies have encouraged the Indian firms to undertake business activities free of bureaucratic control at home and focus on short term, low risk activities available abroad.

### Type of Skills

In its simplest possible explanation, software development process can be broken down into two consecutive stages. The earlier stage of analysis and design can be defined as one where the idea of the software is conceived and the specific requirements are analyzed and designed. The latter stage of coding and testing involves actual writing of the program and testing of its effectivity in applications. As per these definitions, It is, therefore, common knowledge that the former stage of analysis and designing requires mature and sophisticated level of skills and experience. The latter stage of coding

and testing refers to basically non-creative segments of the production process and, hence, defines relatively lower level of skill requirements. As seen in the earlier section, major share of India's software contracts consists of onsite programming services, which fall in the category of coding and testing of software. Consequently, Indian software personnel have most often been employed as programmers rather than as system engineers or designers by their foreign clients. In other words, Indian software workers have worked basically to fulfill the requirements and design specifications set forth by foreign software developers.

## 6. Future Opportunities and Challenges

As has already been stated in the earlier sections, Indian software exporters, at present are mainly focusing their attention mainly on custom computer programming, manpower training, consulting and developing of customized software products. Development of standardized indigenous software packages receives very little attention. Systematic analyses of factors that explain such specific pattern of growth are rare in the literature. In order to bridge this gap, this section focuses on the neglected segment of the software industry, i.e., software packages, and makes a modest attempt to identify the opportunities and constraints for this sector.

## Profit Potential

As it appears from the breakdown of industry revenue by products in Table 5 above, prepackaged software accounts for less than 30% of total export revenue. Yet, it is common knowledge that the latter product, by its very nature, is the most profitable segment of the industry product groups. By being copied at no extra cost, standardized packages allow for increasing returns to scale immediately after their initial stage of development. Hence, this particular product group offers a significant advantage over all other product groups in the software industry; especially, over customized product group. Also, it is interesting to note that in the recent past, Info Tech has surveyed potential markets and concluded that India could be rated above all of its competitors as a software development location. Info Tech rated India above most competitors on availability of skilled labor force, widespread use of English language and competitive labor costs. The score was above average on areas of technical competence, education and training and telecommunication infrastructure. The only two areas where Info Tech found India to fall behind its competitors were government incentives and size of the domestic market. Given India's potential, the question that naturally arises in this context is: Why doesn't India diversify into production and sale of software packages? Obviously, there is no simple answer to this question and, hence, one needs to take a closer look at all possible constraints towards moving in the desired direction.

## Market Constraints

With a constant flow of new entrants in the global software industry, profits from the sale of traditional services, for the Indian software industry, are likely to fall in the future; revenue growth would depend only on growth in number of software workers. In order to survive the increased level of competition in the world market, Indian companies, therefore, would have to develop new products that are at the high end of the value chain. It may be noted in this context that while India's largest software services companies, Wipro and Infosys, reported significant increase in profit in the year 2000, they have experienced increasing competition from a number of low-cost Asian nations<sup>13</sup>.

Available demand estimates suggest that diversification into development and sales of software packages would open up a very large potential market, worth as much as US\$150 billion in the year 2001. However, there appears to be some major barriers to entry into this market. In order to have a preliminary understanding of the factors that hinder Indian firms from shifting the thrust of their production to standardized software packages, we asked the companies in our sample to identify the difficulties encountered within four broad groups of constraint factors: infrastructural constraints;

---

<sup>13</sup> See Business Week (February 26, 2000).

regulatory constraints; risk elements; and marketing and distribution related constraints. A summary of their responses is reported in Table 7.

As it appears from the above table, a number of issues related to infrastructure development, regulation, estimated risks and marketing and distribution network are together responsible for keeping Indian software developers from venturing into the packaged software market. Seen from the standpoint of infrastructure development, lack of internationally compatible hardware capabilities (India has a meager population of just 1 million PCs), inadequate telecommunication services and limited Research and Development (R&D) facilities define the major set of constraints faced by the Indian software producers. Also, a high attrition rate has raised concern among a majority of the producers.

Industrial infrastructure defining provision of power, water and transport is a preliminary requirement for production, irrespective of its specific form. The infrastructure that is of specific interest to the software industry is the provision of telecommunication network. Yet, software companies in India encountered a number of telecommunication problems including shortages of telecommunication links, time lag in accessing such links, poor transmission and high cost of installation and use. Summarizing the concerns of the software companies, NASSCOM had earlier warned of a serious crisis in the software industry in future. Such limitation on telecommunication facilities has discouraged foreign clients from considering offshore software development as a feasible option.

In addition to telecommunications, two other elements in software infrastructure are human resources and power. While the growth of software services export has caused increased opportunities of employment generation in the export sector, this growth, as is indicated by the survey, masks a major problem for the aggregate industry– that of worker turnover, especially the loss of workers to overseas market facilitated by increased number of onsite contracts. Figures given by our respondents suggest that software companies were losing 10-15% of their employees each year, but in some companies, the losses have been as high as 30% in a single year<sup>14</sup>. Such high attrition rate has translated itself into slower growth, poor transfer of skills, reduced incentives for training investments and reinforced dependence on programming services.

Research and Development (R&D) investment is also a major constraint for the growth of software industries. Software developers together with entrepreneurs in many other sectors of Indian industry have experienced poor levels of R&D investments within the industry. Such low levels of R&D has resulted in missed opportunities for development of indigenous technologies and, hence, new software products.

---

<sup>14</sup> These figures are in the ballpark of the survey results reported by Heeks, 1996. Heeks found the attrition rate to be 15-20% each year for most of the companies. For a handful of companies, however, he found the attrition rate to be as high as 50% percent in a single year.

With regard to regulatory constraints, more than 75% of the producers sampled consider poor enforcement of copyright protection laws, both at home and abroad, to be of utmost significance for the insignificant market share of the prepackaged Indian software products. As seen by these producers, piracy of software in India is the rule rather than the exception. With pirated versions of sophisticated software frequently costing less than Rs. 500 (approximately US\$11), domestic producers are affected negatively both in direct and indirect ways. While the direct effect defines the shrinkage in their market share, the indirect effect reflects the downward pressure on their prices. Together, the two effects cause reduced revenues for the domestic producers.

Apparently, the perceived long lag— between conceiving, designing, developing and marketing— in the production of packaged software products, together with the continuously changing nature of production technology and demand in this market, raise the associated risks of the Indian producers at a very high level<sup>15</sup>. In order to reduce the risk component, survive the competition and stay ahead of other producers in the market, Indian producers would need to invest significantly on continuous product and process innovation. On the other hand, since rapid diffusion of innovation prevents full appropriation of returns on

---

<sup>15</sup> As explained by Kopetz (1993), risks involved in software development can manifest themselves as technical failures and management failures. Proper risk management including identification, analysis and elimination of risks, therefore, becomes an integral function of software development process.

investments, individual producers are unwilling to commit themselves to significant investment in these directions. The only way out, therefore, is to have a complementary investment program supported by the government<sup>16</sup>.

As suggested elsewhere, lack of a sizable domestic market has long remained a major problem for Indian software developers. Though the market has grown by over 50% during 1990-95, its size is still small to attract domestic producers to invest in indigenous software development. On the other hand, capturing a major share of the international market requires success in the following two areas: (1) development of a global distribution network to respond effectively to clients' needs and standards; and (2) setting-up of after-sale-service shops to provide support, maintenance and upgrades for the product line. India lags on both the fronts because developing of distribution capabilities and after-sale-service workshops are time consuming and expensive.

## **7. Government's Recent Policy Initiatives during the 1990s**

One of the major policy initiatives that have recently been taken by the Government of India was the formation of a *National Task Force on Information Technology and Software Development* by the Prime Minister in May 1998. The Task

---

<sup>16</sup> The role of U.S. and Japanese government in software related innovation is backed up by evidence in the literature.

Force had a mandate to formulate the draft of a long term National IT Policy for the country. The main objective of the Task Force was to recommend immediate steps that Government needed to take to remove bottlenecks and give boost to India's IT industry in general and software industry in particular. The Task Force has submitted three key reports<sup>17</sup> to the government during a period of ten months (July 1998- April 1999). The Task Force's first report was focussed on software industry development and it submitted the *Information Technology Action Plan: Part-I* comprising of 108 recommendations.

The major recommendations<sup>18</sup> of the Task Force in this report include opening of Internet Gateway access; encouragement for private sector Software Technology Parks (STPs); zero customs and excise duty on It software; income tax exemption to software and services exports; encouragement to set up venture capital funds; 1-3 per cent of Budget of every Ministry/Department for IT applications; networking of all Universities and research institutions; allowing US Dollar linked stock options to employees of Indian software companies; new schemes for students including attractive package for buying computers, etc. The Government has accepted almost all the recommendations and has directed all concerned departments to implement recommendations. Meanwhile, the

---

<sup>17</sup> The three reports are *Information Technology Action Plan- Part I* (July 4, 1998), *Information Technology Action Plan- Part II* (October 26, 1998), and *Information Technology Action Plan- Part III* (April 16, 1999). While the first two reports are on software and hardware industries respectively, the third one is on long-term national IT policy.

<sup>18</sup> *Economic Survey: 1998-99*, p. 109.

Government has set up a new Ministry of Information Technology (MIT) in October 1999, as the nodal agency for facilitating all the initiatives in the Central Government, the State Governments, academia, the private sector and successful Indian IT professionals abroad<sup>19</sup>. More importantly, the MIT has been maintaining a status report<sup>20</sup> indicating the implementation status about the number of recommendations as IMPLEMENTED, NOT IMPLEMENTED<sup>21</sup>, ON-GOING and NOT ACCEPTED.

The Task Force's third report has focussed on the long-term (strategic) national IT policy. The main thrust of its major policy recommendations has been the urgent necessity for raising both productivity and quality of the Indian software industry. Among the major policy recommendations, included are the following:

- Productivity of the Indian Software Industry will be continuously upgraded by de-licensing and de-regulating the import of software productivity tools;
- For keeping pace with the fast changing trends in the software technology, companies and software development organizations will be progressively encouraged to spend at

---

<sup>19</sup> *Economic Survey: 1999-2000*, p. 125.

<sup>20</sup> The status report maintained by the MIT can be found at [www.mit.gov.in/atrnt.htm](http://www.mit.gov.in/atrnt.htm).

<sup>21</sup> The status marked 'NOT IMPLEMENTED' implies a recommendation in the nature where there is no clarity in the proposal or which requires large funds for implementation or could create unbalance within the existing policies.

least one-fifth of their total software budget for the purchase of software productivity and quality tools and nascent software related to the latest software technology trends;

- The high quality of Indian software products and software services exported will be sustained by compulsory insistence of ISO-9000/SEI level-5 Standards or equivalent, certified by one or more competent certification agencies in India;
- In their drive to increase the international credibility, the software companies shall be allowed to utilize a part of their export earnings for putting in place all necessary means for meeting strict delivery schedules and customer satisfaction.

In order to promote quality movement in India's software industry, various initiatives have been taken by the Government, NASSCOM and other organizations. Some of these initiatives are in the form of incentives and grants, while others include promotion and Memorandum of Understandings (MoU). Some of these initiatives as listed by NASSCOM are<sup>22</sup>:

- Software developers who have acquired the quality status of ISO 9000(Series), SEI CMM (Software Engineering Institute Capability Maturity Model) Level 2 and above or equivalent certification<sup>23</sup> are eligible for a grant of Special Import Licenses (SIL) by the Directorate General of Foreign Trade (DGFT), Ministry of Commerce. The entitlement is calculated at 5 percent of the FOB value of export of product or services

---

<sup>22</sup> These are taken from [www.nasscom.org/template/Quality.htm](http://www.nasscom.org/template/Quality.htm).

<sup>23</sup> In India, quality certification is provided by many agencies. However, there is a list of organizations recognized under the Exim Policy of the Ministry of Commerce. The Government of India has also published a list of SEI CMM Level 2 and above certificate issuing authorities, which includes Software Engineering Institute, Carnegie Mellon University; TeraQuest Metrics Inc., USA; Process Transition International Inc., USA; Global Systems Technology, USA; Software Technology Transition, USA; John Ryskowski Consulting, USA; The Process Group, USA; ChangeBridge Inc., USA; Theta Information Systems Inc., USA; and PRT Corporation of America, West Indies. The Government of India constantly updates this list.

made during the preceding licensing year. SIL can be sold in the open market at a premium;

- Exim Bank has announced a scheme whereby the bank could subsidize software-exporting companies with up to 50 percent of the cost for acquiring the quality certification. Towards this end, NASSCOM and Exim Bank have already signed a MoU.
- Ministry of Information Technology has taken the initiative in bringing the best in the world in the area of Software Testing and Assessment of Software Maturity through licensing arrangements with Software Engineering Institute, Carnegie Mellon University, USA. Under this scheme, STQC Directorate of Ministry of Information Technology is undertaking the job of Certification, Testing and Training of trainers and assessors in India.

It is noteworthy<sup>24</sup> that India's software industry has achieved the distinction for providing quality services. As of December 1999, 170 Indian software companies have acquired international quality certification. More interestingly, 15 out of 23 companies in the world that have acquired SEI CMM Level 5 maturity (the highest quality standard for software practices) are located in India. Furthermore, majority of the multinational companies operating in the area of information technology have either Software Development Centers or Research and Development Centers located in India. Thirty percent of the e-commerce start-ups during the year 1999 in Silicon Valley, USA were initiated by Indians. Around 500 portals are being launched in India every month.

---

<sup>24</sup> Quoted from *Economic Survey: 2000-2001*, p. 143.

Recently, the Government of India has approved setting up of an IT venture capital fund of Rs.100 crore<sup>25</sup> for software companies. It has recently taken a series of measures to develop a road map for India in e-commerce<sup>26</sup>. These are in information & communication technology infrastructure, legal and regulatory framework, technology for electronic commerce (e-commerce) including test-beds, issues related to international domain names, etc. More recently, the Government has enacted an Information Technology (IT) Act, 2000 not only to provide a legal framework for e-commerce and prevention of computer crimes, but also to accelerate induction of IT in critical sectors of the Indian economy. The Act aims to recognize electronic contracts, electronic filing/documentation, digital signature, etc. Rules under the Act have been notified and the Act came into force on 17<sup>th</sup> October 2000. The Controller of Certifying Authority has been appointed.

According to NASSCOM, the software industry in India expects to reach an export level of US\$ 6.24 billion by 2000-01 and US\$ 9.5 billion by 2001-02. The NASSCOM-McKinsey report 2001 has set a target of US\$ 50 billion of annual IT software and services exports by 2008 and expects India centric companies to earn revenues of US\$ 12 billion by 2008. There is little doubt that the growth of India's software exports has been mainly due to India's reputation of high

---

<sup>25</sup> Rs.100 crore is approximately equal to US\$21.5 million (at the current exchange rate).

<sup>26</sup> *Economic Survey: 1999-2000*, p. 125 and *Economic Survey: 2000-2001*, p. 143.

quality and cost effectiveness. According to US government estimates, more than 260 of Fortune 1000 companies outsourced their mission critical software development to India in the year 2000. Undoubtedly, one of the major strengths for India lies in having the world's second largest pool of scientific manpower that is also English speaking. Lately, the Government of India has taken steps to triple the number of engineering graduates by the year 2008.

One can now go back to a study by Peter Evans (1992) who 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 have been made by the central government regulatory agencies and state-owned enterprises in the high technology industry to increase state actions aimed at complementing and promoting private entrepreneurship during the 1980s. This change in the orientation of the Indian state has been reinforced more strongly since the adoption of liberalized economic policy in July 1991 and more so since May 1998 as the above analysis suggests. Moreover, announcement of IT policies by many state governments has further strengthened India's position in the software-driven IT sector in the world<sup>27</sup>.

---

<sup>27</sup> According to NASSCOM report in 2000, 19 state governments have announced their IT policies, while many more are in the offing.

## 8. Conclusion

With data gathered from a sample of 68 software developers in India, this paper provides an analytical framework to examine the organization, size and export performance of the Indian software industry. Organization of the industry has been looked at from the standpoint of its legal structure as well as its degree of concentration. The size of the industry has been examined by giving careful attention to relative significance of its domestic and export markets. With a preliminary assessment of the current state of the Indian software industry, its future opportunities together with the major roadblocks towards growth in the desired direction have been identified. Attention has also been drawn to the recent initiatives taken by the Government of India as genuine attempts for removing some of the major roadblocks.

The analysis in this paper reveals that foreign participation in terms of joint venture corporation or subsidiary organization still remains limited in the Indian software industry. The industry is represented mainly by the private domestic limited companies. Also, a majority of these firms are engaged in contractual programming and designing activities. Though large in number, most of the programming and designing related firms are small in terms of both their size of assets and level of earnings. Only a handful has an asset size larger than Rs. 300 million. Similarly, very few earn revenue in excess of Rs. 500 million. Within the

group of prepackaged software, however, more than 25% of the firms claim to have annual earnings in excess of Rs. 500 million.

Viewed as a source of employment, firms engaged in programming services account for the major share of employment in the industry. However, each of the three groups of firms examined in this paper fared poorly when seen in terms of their contributions towards national employment. Altogether, they define only 0.01% of national employment.

The insignificant domestic market explains only 17.5% of the total software revenue and contrasts strikingly with that in the developed countries of United States, Western Europe and Japan. A breakdown of sources of revenue by product groups confirms significant dependence on export market. What compounds this dependence is the evidence of excessive reliance on one principal market, namely the United States. More than 60% of revenue for this industry is generated in the U.S. market.

A close scrutiny of the export profile reveals that while being concentrated in the U.S. market, India's software exports is skewed towards custom software work and programming services. Development and sale of prepackaged software defines a negligible share of software export. This is in sharp contrast with the export pattern exhibited by its close competitors in Asia and South America. The competitor countries demonstrate varying degree of success in

diversifying their exports to sale of software packages. In addition to being skewed towards services, majority of India's software exports is produced abroad at client's site rather than at offshore locations. Such predominance of onsite work has simply added to India's vulnerability by characterizing its exports as low-skill, low-technology, low-investment and low-return options.

As per the future outlook of this industry, both the domestic and the international market for its products and services are growing at a rapid rate. To take advantage of the opportunities generated by the expanded markets, both the industry and Government of India are currently taking some bold and purposeful steps:

Amongst others, this exercise includes path-breaking measures by the government to further liberate the economy, simplification of procedures, deployment of additional resources for technical manpower development, new marketing channels, enhancing global brand equity and providing state-of-the-art infrastructure for software development. E-commerce solutions, software development, interactive integration services, Application Service Providers and It-enabled services are leading the way<sup>28</sup>.

---

<sup>28</sup> Quoted from NASSCOM Report 2001.

## References

- Bhargava, Sunita Wadekar, "Software from India? Yes, It's for Real," *Business Week*, 18 January (1993), p. 77.
- Chandrasekaran, V., "Business Quality- The Cutting Edge," *Management Review*, January-March (1996), pp. 12-20.
- Economic Survey: 1998-99 (New Delhi: Government of India, 1999).
- Economic Survey: 1999-2000 (New Delhi: Government of India, 2000).
- Economic Survey: 2000-2001 (New Delhi: Government of India, 2001).
- Evans, Peter, "Indian Informatics in the 1980's: The Changing Character of State Involvement," *World Development*, Vol. 20, No. 1 (1992), pp. 1-18.
- Heeks, Richard, *India's Software Industry: State Policy, Liberalization and Industrial Development* (New Delhi: Sage Publications, 1996).
- Info Tech Consulting Inc., *India's Software & Services Export Potential & Strategies* (New Jersey: Parsippany, 1992)
- Information Technology Action Plan-I* (New Delhi: Government of India, July 1998).
- Information Technology Action Plan-II* (New Delhi: Government of India, October 1998).
- Information Technology Action Plan-III* (New Delhi: Government of India, April 1999).
- Kopetz, Hermann, "The Software Market: Emerging Trends," in *Software Industry: Current Trends and Implications for Developing Countries* (Vienna: United Nations Industrial Development Organization, 1993).

- Mowery, David C. (ed.), *The International Computer Software Industry: A Comparative Study of Industry Evolution and Structure* (New York: Oxford University Press, 1996).
- Premchander, "Indian Software Industry: A Diagnostic Analysis," *Management Review*, January-March (1997), pp. 11-19.
- Siwek, Stephen E. and Harold W. Furchtgott-Roth, *International Trade in Computer Software*, (Westport: Quorum Books, 1993).
- Vijayan, Jaikumar, "In Depth: Look Out, Here Comes India," *Computerworld*, 26 February (1996), pp. 101-104.
- Zielenziger, Michael, "By Design: India's Software Houses Lure Foreign Money", *Far Eastern Economic Review*, 10 August (1995), pp. 64-65.

**Table 1: Industry Organization: Computer Software**

Structure	Custom Programming	Prepackaged Software	Custom Designing	Total
Private Limited	15	16	6	37
Public Limited	8	7	4	19
Subsidiary	8	3	1	12
Total	31	26	11	68

Source: Authors' compilation of survey results

**Table 2. Industry Concentration: Computer Software**

Industry Group	No. of Firms	Total Assets (millions of rupees)	Firms with asset size more than Rs. 300 mil	Total Revenue (millions of rupees)	Firms with more than Rs. 500 mil in revenue	Industry revenue concentration of 4 largest firms
Custom Programming	31	3224	2	6240.3	5	72.3%
Prepackaged Software	26	3228	6	5070.0	7	39.6%
Custom Designing	11	1562	3	2596.0	3	32.1%
Core Industry	68	8114	11	13906.3	15	53.4%

Source: Authors' compilation of survey results

**Table 3: Employment in Core Software Industry of India (thousands of employees)**

	Custom Computer Programming	Prepackaged Software	Custom Designing	Total
No. of Employees (thousands)	18.63	18.12	2.68	39.43
Share of industry Employment	47.24%	45.96%	6.8%	100%
Share of National Employment	0.005%	0.005%	0.0006%	0.01%

Source: Authors' compilation of survey results

**Table 4: Domestic Share of Software Revenue for India, Western Europe, Japan and the U.S.**

Product Group	United States	Western Europe	Japan	India
Custom Programming services	52%	41%	21%	19.4%
Software Packages	42%	36%	21%	23%
Custom Designing	18%	8.2%	14%	---
Core Industry	75%	90%	56%	17.5%

Source: Mowery (1996), Authors' compilation of survey results

**Table 5: India's Computer Software Industry: Sources of Revenue (in percentages)**

Industry Groups	Sources of Revenue			
	Domestic	United States	Europe	Asia and others
Custom computer Programming	19.4%	60%	13.2%	7.4%
Prepackaged Software	23%	58%	7%	12%
Custom Designing	---	74%	20%	6%
Core Industry	17.5%	61.5%	12.1%	8.9%

Source: Authors' compilation of survey results

**Table 6: Software Export Profiles of India and its Competitors in mid 1990s.**

Proportion of Exports in Each Category (%)			
Country	Software Services(exclndg data entry)	Software Packages	Data Entry
India	90	5	5
Ireland	65	21	14
Mexico	53	32	15
Philippines	39	20	41
Singapore	25	58	17
China	17	56	27
Israel	19	76	5

Source: Heeks (1996): India's Software Industry: State Policy, Liberalization and Industrial Development

**Table 7: Constraints Encountered by Indian Software Industries**

Constraint Factors	Agree	Disagree	Not Sure
<u>Infrastructure</u>			
Limited R&D Facilities	41	24	3
Lack of Hardware Capabilities	46	22	2
Poor Quality Control	35	33	2
Inadequate Telecom. Services	43	23	4
High Attrition Rate	48	16	4
<u>Regulation</u>			
Inability to Protect Copyright	51	15	2
Non-Conducive Tech. Policies	23	40	5
<u>Risk</u>			
Long designing--marketing Lag	53	13	2
Limited Funds for Investment. in Continuous Innovation	42	26	---
<u>Mktng &amp; Distribution</u>			
Limited Domestic Market	54	13	1
Poor Intl. Distrbn. Network	49	18	1
Absence of After-sale-services	50	16	2

Source: Authors' Compilation of survey results