Introduction
The high-visibility success of Indian Information Technology (IT) industry has impressed the industry observers and researchers alike. Policy makers have started believing that the spectacular growth of software segment is an unexpected opportunity for Indian economy to grow along with the IT revolution. The success in the glamorous software segment and the dynamics of growth in the nascent domestic computer hardware industry are now giving way to more realistic assessment of strengths and weaknesses and its prospects for the future. The boom of the present computer industry is essentially driven by the impressive software export performance. However the hardware segment remains inward looking. The orientation of the domestic hardware market has emerged as a predominantly kit-assembling industry, which is heavily dependent upon the import of high-tech products and components. The historical performance of the hardware sector, however, had not been less commendable before. Brunner (1991) had shown how successive policy regime helped the Indian computer hardware industry achieve maturity in terms of technological competence. The domestic IT industry which was earlier dominated by the hardware sector has been rapidly shifting towards software.\(^1\) The share of hardware, which was about 60 per cent in 1994-95 has dipped to 46 per cent in 1998-99. This has been accompanied by a sudden spurt in growth of software industry.

According to many industry observers, Indian software industry represents one of the most successful business models that can help to sustain the growth and competitiveness of the country. It has been observed that with software (export) as the driving engine, since early 90’s, the Indian IT industry has been growing at a phenomenal rate. Moreover, software driven IT industry is today at the top of India’s national agenda.

\(^1\) Heeks (1995) attributes this to import liberalization.
as an instrument and a model, for the modernization of India’s economy. At the same
time, it has been argued in many literatures that the success story of Indian software
export is based on the basic rule of exploiting the labor cost differential between India
and the US for fairly low value added software services. Some studies (Kumar 2001)
have, however, pointed out that the industry would have to move up the value chain if it
is to sustain and enhance its competitive position in near future. This poses the basic
issues of growth sustainability and global supremacy of the Indian software industry. Our
study would analyze this issue from various perspectives.

In the next section at the present chapter, we observe the worth of the industry in
comparison with to other important sectors of the economy. We argue from observations
that the software sector has emerged as one of the major export earners for the country
and therefore its sustainability is an important question. The second section presents a
comparative analysis of Indian software industry vis-à-vis other countries’ software
industry to know its competitive position in the global market. The third section carries
out a brief history of the hardware sector, which is highly inter linked to the software
sector. The story narrates how technologically competitive hardware sector in India has
been steadily losing its importance in favor of low value added software product and
services sector and therefore highlights the sustainability issue. The fourth section
presents critical reviews of the status of Indian software industry based on the available
literature. Literature review reveals that the basic characteristic of Indian software
industry is low value/ low skill/ low risk/ low investment activities. On the contrary IT
Task force has set up the vision of making India’s software superpower and building
strong hardware capability by 2008. These two contrasting arguments emphasize the need
for sustainability – an important matter for discussion. This is followed by the fifth section, wherein we highlight our research questions and further chapterization of our study.

1.1 Worth of the Industry

Indian Information Technology (IT) industry (predominantly software industry) is among the fastest growing sectors of the economy. It has been earmarked as a thrust area for generating huge employment and export promotion avenues. This was started with the declaration & subsequent implementation of the Computer Software Policy in 1986. The Indian IT industry has notched up a whopping Rs. 243.5 billion (US$ 5.75 billion) in 1999-2000 from a meager Rs.3 billion (US$ 150 million) 10 years back. The growth of the software sector in 1999-2000 was over 30% as compared to about 8% of the overall industrial growth rate. The growth rate of the other three major sectors in the industry – mining, manufacturing and electricity was only 0.7%, 9.3% and 6.6% respectively in 1999-2000.

The export performance of the software sector is equally impressive. With a modest beginning in 1984-85, software and services exports has moved up to Rs.25.2 billion (US$ 734 million) in 1995-96 and to Rs.171.5 billion (US$ 4 billion) in 1999-2000 and has exported to more than 91 countries around the world. It is expected that the export revenue will grow to US$ 50 billion by the end of 2008. In terms of Indian rupees, the compound annual growth rate (CAGR) for the Indian software industry revenues in the past 5 years has been over 55 per cent. The CAGR for the software export industry in the past 5 years has been over 62 per cent compared with a CAGR of about 47

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2 Statistics are obtained from www.nasscom.org/template/itindia.htm.
per cent for its domestic market revenue during the same period. In terms of US dollar, the export growth of overall economy was about 12% in 1999-2000, compared with the IT software and services export industry to over 50%. This indicates that the industry has emerged as one of the major export earners for the country, contributing more than 14 per cent of total merchandise exports. Figure 1 demonstrates Indian software exports as a percentage of total Indian exports, which has amplified from 2.37 percent in 1995-96 to 14.13 percent in 2000-01.

![Figure: 1 Indian Software Exports as a Percentage of Total Indian Exports](image)

Source: NASSCOM Press Release (July 24, 2002)

If we look at the share of IT industry in India’s GDP, we observe that the IT industry has already grown from 0.3 percent contribution to the GDP in 1990-91 to 1.5 percent in 1999. Total exports’ share of the economy as a percentage of GDP was 8.9%.

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4 Business India, January 21 to February 3, 2002.

5 Source: NASSCOM, Over 60 per cent of software exports in 2001 were destined for the US market.
during 1999-2000. Figure 2 shows the growth of Indian IT software sector as a percentage of India’s GDP.

**Figure: 2 Indian Software Industry as a Percentage of India’s GDP**

![Graph showing growth of Indian software industry as a percentage of GDP from 1997-98 to 2000-01.]

Source: NASSCOM Press Release (July 24, 2002)

From figure 3 it is clear that in comparison to the gems and jewellery sector, which is one of the primary export earners for the country, the growth of the software sector has been more rapid and commendable. Unlike labor-intensive export-driven gems, jewellery and garments sectors, software is considered as more skill driven and knowledge intensive. With the high expectation of international competitiveness in such a high-skill service industry, industry watchers and policy makers along with popular media have given special attention to the software industry and proposed it as a solution for solving India’s chronic developmental problems of low economic growth and high unemployment rate (IT Task Force 1998).

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6 Economic Editors’ Conference 2001, Press Information Bureau, Government of India. Source: http://www.nic.in
Figure: 3 Export of Gems & Jewellery and Software

<table>
<thead>
<tr>
<th>Year</th>
<th>Gems &amp; Jewellery</th>
<th>Software</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996-97</td>
<td>5000</td>
<td>4000</td>
</tr>
<tr>
<td>1997-98</td>
<td>6000</td>
<td>5000</td>
</tr>
<tr>
<td>1998-99</td>
<td>7000</td>
<td>6000</td>
</tr>
<tr>
<td>1999-00</td>
<td>8000</td>
<td>7000</td>
</tr>
<tr>
<td>2000-01</td>
<td>9000</td>
<td>8000</td>
</tr>
</tbody>
</table>

Source: The Gem & Jewellery Export Promotion Council, NASSCOM

Question is whether the software industry of India will be able to maintain its present worth in future.

1.2 Software Industry in Other Countries

A brief comparative study of the software industry in India with other industrialized and developing countries will help to make out the status of the industry in the global market. Let us take the case of Japan, which has a long history of industrialization. The structure of Japan’s software industry seems complex. The software industry is said to be underdeveloped in Japan, but intrafirm software for consumer electronics i.e. shipping, machine tools, semi-conductors, and so forth is strong and competitive (Baba 1995). Hidden inside the fax machines, washing machines, video cameras and auto engines are some of the slickest technologies ever to leave Japanese factories. The video game industry, which requires high-level software programming, is completely dominated by Japan. It is therefore the economics of the consumers’ business
rather than the economics of the software industry that determines large organizations' demand for and usage of software. In 1999-2000, Japan's software industry employed 534,000 people and produced US $85 billion compared to US $5.75 billion in India. The total software market of Japan is expected to grow steadily, approximately 10-12% annually over the next five years. The software market in Germany was more than $12 billion in 1999 and the near-term outlook remains very positive, with anticipated growth rates in the 13 per cent range. UK's software market in 1999 was over $10 billion. Italy is Europe's fourth-largest computer software market with the size of over US $3.2 billion in 1999 and expected to grow 10 per cent annually over the next three years.

Like many other newly developing countries, Ireland and Brazil have grown very rapidly in the 90s. Software revenues accounted over $7.7 billion in Ireland in 1997-98 (Arora 2001). Like India, software activities are quite important for the growth of these economies. In 1999, the IT industry of Brazil has outpaced its overall economic performance. While the Brazilian GDP has grown 1%, the IT sector has grown 15.3% more than the previous year. During 1994-1998, IT market has had an average annual growth of 18.6% in Brazil, while during the same period the GDP has not grown beyond 3.35%. The result of software industry, therefore, clearly outpaced the overall growth of Brazilian economy.

Although India's performance is comparable with a few developing countries, at the same time it is to be noted that despite rapid growth and many cost-related and technical advantages in this sector, both the size of the domestic market and share in the

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8 Source: US Department of State FY2001 Country Commercial Guide
9 Software accounted for over 10% of GDP real growth in India (Kumar, 2000)
10 Source: US Department of State FY2001 Country Commercial Guide
total global export market is negligible. The share of Indian software export is tiny - less than 1 per cent of the total global market and has stagnated there for quite some time. This indicates that the global market is expanding at a much faster rate vis-à-vis the capability of Indian software industry in expanding its share in the global market. Tremendous effort is required to raise its share in the global market since many developing countries are quite close in the race.

1.3 The Hardware Story

The software industry cannot be studied in isolation from the hardware industry. Software and hardware are mutually complementary to each other. In every developed country, hardware sector is intimately related to the software sector. The wide application of microelectronics in industrial products and processes offers the opportunity for interdependent growth of both the sectors, which is the key success identified in the developed countries.

In contrast to the software industry, both low margins and low growth characterize the hardware sector. This sector had shown great promise in initial days both in terms of technological capabilities as well as penetration in the international market (Brunner 1991). Various factors contributed to the decline of the hardware segment of the Indian IT industry. The table 1 below gives a snap shot view of the growth and decline of the software and hardware segments of the Indian IT industry.
Table: 1 Indian Software and Hardware Market

<table>
<thead>
<tr>
<th>Year</th>
<th>Software (Rs. Million)</th>
<th>Hardware (Rs. Million)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Domestic</td>
<td>Exports</td>
</tr>
<tr>
<td>1994-95</td>
<td>10,700</td>
<td>15,350</td>
</tr>
<tr>
<td>1995-96</td>
<td>16,700</td>
<td>25,200</td>
</tr>
<tr>
<td>1996-97</td>
<td>24,100</td>
<td>39,000</td>
</tr>
<tr>
<td>1997-98</td>
<td>35,100</td>
<td>65,300</td>
</tr>
<tr>
<td>1998-99</td>
<td>49,500</td>
<td>109,400</td>
</tr>
</tbody>
</table>


Figure: 4 Composition of Indian IT Industry


What is to be observed in the above two figures is an inverse growth that two segments have taken to, while being part of the same industry. The software segment is
witnessing a higher rate of growth of the export market as compared to the domestic market. At the end of the last millennium the size of the export market became more than double the home market. On the other side, export market for the hardware has dwindled. While landmark achievement has been made in the software sector, the hardware sector has experienced a sharp decline in exports. Similar trend is observed in domestic hardware sector, which has started declining after reaching its absolute peak in 1997-98. Over the years, the hardware industry in India has been steadily losing ground to the software and services industry. Recent studies (Heeks 1995, Kumar 2001, D’Costa 2002) have argued that the increasing number of technological collaborations in software has brought with them state-of-the-art hardware tools needed for software development as well as the much-needed canals for exports.

Table: 2 Product Combinations Offered by Firms

<table>
<thead>
<tr>
<th>Product Groups</th>
<th>Number of firms (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware</td>
<td>37 (3.66)</td>
</tr>
<tr>
<td>Software</td>
<td>437 (43.18)</td>
</tr>
<tr>
<td>Peripherals</td>
<td>289 (28.56)</td>
</tr>
<tr>
<td>All three</td>
<td>29 (2.87)</td>
</tr>
<tr>
<td>Hardware and Software</td>
<td>62 (6.13)</td>
</tr>
<tr>
<td>Software and Peripherals</td>
<td>19 (1.87)</td>
</tr>
<tr>
<td>Hardware and Peripherals</td>
<td>120 (11.86)</td>
</tr>
<tr>
<td>No information</td>
<td>19 (1.87)</td>
</tr>
<tr>
<td>Total</td>
<td>1,012 (100.00)</td>
</tr>
</tbody>
</table>

Source: Constructed from the data reported in Data Quest, 1998

If we divide the whole Indian IT industry in broad groups of hardware, software and peripherals, from table 2, we notice that there is more crowding in the software sector of the industry. There are, however, firms having interest in all sectors of the industry or in some combinations of sectors. But the boom of present computer industry is essentially because of impressive software export performance. Unfortunately, however, the inward
looking hardware segment is being neglected. Software exports are in fact attractive due
to the structural weaknesses (discussed in detail in subsequent chapters) of the Indian
economy. The entry in the software segment is easier because the capital requirement is
much less as compared to other segments of the industry.

The orientation of domestic hardware market has emerged as a predominantly kit-
assembling industry, heavily dependent upon import of high-tech products and
components. However, earlier Indian firms could develop substantial designing capability
in micro and mini computer segment. Although it had undergone several ups and downs,
various policy interventions from 1972 onwards made new entries possible in this sector.
Right from the early years of the information evolution, India had made a determined
effort to build up a viable base for manufacturing computer hardware. Brunner (1991)
had shown how successive policy regime helped Indian computer hardware industry
achieve maturity in terms of technological competence. One of the major features of the
new entry in the hardware segment, unlike its software counter part, was that most of the
firms began as kit assemblers, but many of them indulged in capability development
through substantial R&D efforts for designing their own machine. Thus WIPRO could
develop the first machine based on 386 chips, and DCM could come out with first 486
machine even before the world giants (Heeks 1995). While this was no mean
achievement, the industry has been handicapped because of almost total absence of
modern component industry (in terms of cost, quality and new innovations) and has
remained fully dependent on import. The fate of the industry, therefore, has always been
hanging on the related import policies of government. As Heeks (1995) pointed out that
government policies in this regard were always caught in the conflict between component
users and component manufacturers. After full liberalization of import of components in 1991 and government's over-enthusiastic support for software export, the domestic component industry faced the ultimate doom and resulted in adverse fall-outs of India's hardware industry.

Once the assembly lines were automated in the 90s, India's large IT firms found software exports to be a more lucrative domain and therefore started moving away from hardware production, in turn creating opportunity for "home-growth" exports. Given the barrier of scale economies, brand name, marketing channels, finance, skills and quality, a tie-up with a foreign IT multinational was the only way to begin large scale exports. As a result, the share of hardware, which was 60 per cent in 1994-95, dipped to 46 per cent in 1998-99 with a sudden spurt in both software and its related services. In recent times, the increasing number of technological collaborations in software brings with them state-of-the-art hardware tools for software development thus foregoing the need for hardware R&D in the country. Table: 1 portrays the composition of domestic and export IT market in India. It is clear from the table that while there has been landmark achievement in the software sector, the hardware sector has experienced a sharp decline in exports. Over the years, the hardware industry in India has been steadily losing its industry share in favor of software and services industry. Since interdependent growth of both hardware & software is the key to success, recognized by developing countries, growth of only software & service sectors in India raises the issue of sustainability in near future.

1.4 Critical Reviews of the Status of Indian Software Industry

The status of software industry is important to know for the discussion of the sustainability issue. Currently, a majority of the research conducted in the field of Indian
software industry has been in the form of explaining the spectacular export performance of the industry. In the recent past, a variety of studies such as policy-oriented, technology-oriented and business-oriented have been conducted by academic groups (in India as well as outside), to analyze and examine the performance of the Indian software industry. However, some studies have identified significant challenges to the growth performance in the form of growing scarcity of talent, rising wage costs and emerging competition (Kumar 2001). This literature review focuses on finding out the current status of Indian software industry and in turn the problems that could hinder the growth, set at blistering pace in the 90s.

A brief historical background of software industry will help us to understand the current status of the industry better. The emerging convergence of computer, communications and control technologies, which had started in the 80s, had opened up immense possibilities for using information technology for increasing productivity and improving efficiency, among other things. Most of the big companies in the world started realizing the importance and use of information technology. They tried to integrate IT into the production system as well as all other aspects of business. But instead of in-house software capability development, they started outsourcing part or all of their software development and started focusing increasingly on core competencies (such as developing applications for old computer platforms). As companies faced an increasingly competitive marketplace and strove to manage the shrinking product life cycle, strategic outsourcing had become a much-preferred strategy for many leading software companies. Big software firms were also focusing their efforts on research and development. They especially liked to free their in-house IT staff from mundane maintenance tasks for more
creative projects and had begun to outsource the lower value added activities (Arora 2001, Hicks 1995). In other words, outsourcing allowed the big firms to increase their focus and ability to invest in core competencies, including product development, marketing and customer relationship. Thus the global demand for outsourcing of low value added task increased along with the emergence of communication and control technology.

At the same time, the policy mechanism had enhanced the supply side capabilities to emerge as the source of cheap and skilled manpower for low value added job. The liberalized trade regime in India had helped big foreign software firms to decide on outsourcing as a preferred strategy. Having identified the traditional import substituting approach as unlikely to be cost-efficient in a high-tech sphere (such as information technology) in India, some studies suggested to evolve suitable latecomer export oriented strategies (Mahalingam 1989). On the contrary, some studies (Patibandla 2000) identified the critical role of government’s import substitution policy in the birth of information technology industry in India. The supporters of import substitution policy argued that India’s software industry was the by-product of import substitution facilitated by certain supply side policy support with trade-openness by the government. The previous policy of investing in higher educational technical institutions generated a large pool of skilled manpower, which became the basis for the birth of the software industry. The argument given by the export oriented strategy followers’ was based on the fact that as India had a pool of low cost technically qualified English speaking personnel, it should adopt a less labor intensive and more skill oriented approach. The opportunities identified in export orientation, emphasized on software customization, modification, systems integration and
related support services such as maintenance and debugging operations. The study argued that “it was necessary to make a distinction between computers as a tool for the overall betterment of the economy on the one hand and computers as an industry capable of generating resources through meaningful participation in the global trade for the products of information technology industry on the other. The two need not be conflicting” (Mahalingam 1998; pg. 2379).

Studies on the status and potentiality of Indian software industry have broadly focused on the following aspects:

i) Hardware software complementarily and the prospects of Indian software industry

ii) Domestic vs. export market focus – the relative importance for longer term gains

iii) Long term sustainability of the software industry that is based on the cheap skilled labor and low skill/low value services

A large pool of cheap skilled manpower became the foundation of the Indian software industry. However, Brunner (1991) pointed out that in future, developing economies might not be able to rely solely on cheap skilled labor (which was said to be the competitive advantage of newly industrializing countries) and intermediate technologies for their economic growth. Automation might make it possible to reduce costs significantly and this would lead MNCs to move their offshore operations back to their home country. In his study, Brunner had shown how industrial policy of India in the 80s had changed, favoring an emerging domestic computer hardware industry to obtain necessary technology inputs that provided for an increased level of domestic as well as
international competition. WIPRO, an indigenous Indian firm for example could design and manufacture the world’s first mini system in 1986, based on Intel’s new 386 microchip well before the US counterpart. At the same time “a few large domestic computer firms had been able to design and manufacture systems embodying a level of hardware technology that enabled them to be exported to the US and Japan” (Burnner 1991; pg. 1740).

However, the destiny of Indian computer industry changed very rapidly. Once the core capability of hardware and software development was established in the early 80s and became well entrenched in the industrial scenario in India, the future development of the industry took two different turns. One was quick diffusion of software related capability and the other was the gradual erosion of domestic hardware base and export dependent growth of the industry. As it happens in all other industries, in software also around the core capability of the industry a large number of small and tiny enterprises were gradually coming up mainly in peripheral activities related to software. Many of these enterprises were essentially engaged in low skill activities like data entry, testing, debugging etc. for the enterprises that formed the core. The low skill work related to software diffused very quickly all over the country.

Like India, for countries without a relatively active and up-to-date software sector, Schware (1992) recommended a proposition of software industry entry strategies for developing countries, which is known as “walking on two legs” (domestic leg and export leg). He believed that for the developing countries, “catch-up” in terms of capital outlays, labor, skills and the growing importance of technology change are difficult for software production. Identifying the difference in the learning curves of domestic and
international market activities, his study suggests that countries need to pay more attention to domestic opportunities. These opportunities have high returns in terms of gaining experience and innovation in software production, and provide training that allows a broadening of software exports. In his study, the experiences of the software industry in India (walks on export leg) and Brazil (walks on domestic leg) suggest that the scale and degree of sophistication of the software sector are a function of the overall extent of computerization of the economy. Heeks also emphasizes "domestic-orientation for software brings greater returns to the national economy, even in terms of foreign exchange, than exports...software for domestic consumption can improve the competitiveness of Indian firms who can export more efficiently from India" (Heeks 1996, pg. 157).

How the policy of import liberalization assisted Indian firms to shift from hardware production to assembly lines (import of components) and finally software exports has been reflected in Heeks (1995, 1996) study. He pointed out that through import liberalization and export incentives, the Indian government has been single-mindedly pushing for software exports. Indian software companies also choose to set up export orientation because of several factors. The perception was that, exports although a low value added activity, offered a huge market and possibilities of quick returns and high earnings with low risk accompanied by low investment and low barriers to entry. Other influencing factors were up-to-date technology awareness and skills, staff motivation and good company image and track record. Heeks study seeks to investigate the short-term gains (if any) and long-term dangers in continuing with such an exclusively export-oriented policy. Moreover, he seeks to explore the spin-offs (if any)
from the software industry to the other Indian industries and other facets of the Indian economy. It is clear from his study that mainstream software industry has deliberately neglected the domestic market in favor of exports. After taking into account the expenses incurred in import of software tools and hardware (and also other expenses like living and travel allowances for onsite job, marketing etc.) Heeks conjectures that “India probably has a negative balance of trade in software and was a net software importer after 1986” (Narasiman 1996; pg. 2073).

In a nutshell, the software industry of India has been characterized as low value / low skill / low risk / low investment activities in almost all the studies in the early 90s. Recently, survey based studies of the structure of the software industry have indicated the vulnerability of the industry arising out of lack of diversification of exportable that is mainly constituted by mundane services such as low level programming and maintenance (Chakraborty et al 2001, Arora et al 2001). However the possibility of being trapped at the low-return end of the division of labor was already echoed by the Indian sector in the early 90’s (see Evans, 1995: pg. 194 - 96). While the need for consolidation of the gains in the export market through moving up the value chain and creating trained manpower has been pointed out (Kumar 2001), the structural dislocation (Joseph et al 2001) and misallocation of valuable talent by luring human capital from other sectors (Balasubramanyam & Balasubramanyam, 1997) - resulting from export centric growth have also been highlighted. All these studies have also indicated the need for diffusion of IT use in domestic industries along with better infrastructure, and skilled manpower for enhancing productivity & efficiency in a wide range of economic activities, therefore maximizing the gains from software industry. In the absence of IT use in the domestic
industries, the benefits of spatial dispersion of high skill activities are truncated and that can in turn hinder the spectacular growth of software industry in near future.

Many of these views have been reflected in the report of the IT Task Force of 1998.\textsuperscript{11} The Task Force has set the vision of making India a software superpower (IT Action Plan Part I) and building strong hardware capability (IT Action Plan Part II) by 2008. "The 108 Recommendations of the IT Action Plan Part I emphasize the policy framework required for the accelerated flow of investment into the IT sector, with specific orientation towards the software industry. The Information Technology Action Plan II furnish 84 policy instruments for the development, manufacture and export of IT hardware. These policies are oriented towards the creation of appropriate investment climate and streamlining the procedures for minimizing uncertainty, increasing velocity of business and growing a proactive enterprise with market aggressiveness and inventive resilience. The Task Force advocated that the software industry and the hardware industry are two sides of the gold coin representing India emerging as a global IT superpower. The success of one, whether it is export of software of $50 billion by the year 2008 or IT penetration drive for realizing IT for all by 2008, depends on the concomitant success of the others." While the report of the Task Force mentions the importance of concomitant growth of both hardware and software segments of the IT industry of India, it is silent on the mechanism that would mutually reinforce the growth of each other.

Though 108 Point recommendation of Task Force does contain several positive components for the IT industry at large, unfortunately it also has several gaps. One of the

\textsuperscript{11} Full report of the Task Force is available in http://it-taskforce.nic.in
basic flaws is that it benefits large companies while neglecting many startups. Many studies argued that multinationals and large Indian firms supplying low value-added software services currently dominate the IT industry, whereas startups are relatively insignificant. The large players that operate for corporate IT development is expected to benefit greatly from the proposed Task Force 108 Point recommendation. Startups seem to benefit less from the recommendation than large organizations, as they require greater university and research support along with finance, elements that this recommendation does not cover. Large companies already have access to finance and can undertake low value-added activities that are not research intensive.

In order to “position India in context of paradigm shift to 'Hub for globally competitive value services' as against talent provider”, most visible policy intervention from government of India and few state governments has been in the form of setting up Software Technology Parks (STP)\textsuperscript{12} to sustaining India's advantage and protecting future earnings. This is in addition to various fiscal and other regulatory incentives for attracting new investment and making the process of setting up new ventures easier within and outside the country.\textsuperscript{13} Government of India has been initiated to take market driven

\textsuperscript{12} The Department of Electronics (DoE) established three parks at Pune, Bangalore and Bhubaneswar in 1990. In early 1991, it was decided to set up four additional STPs at Gandhinagar, Noida, Tiruvananthapuram and Hyderabad. About 62 companies had been approved to set up software exports units in these four parks during the year. A new autonomous society under the name of Software Technology Parks of India (STPI) was registered in June 1991 at Delhi to manage all the STPs in the country. Other than management of STPs, STPI support entrepreneurs by providing various professional services like insurance of import certificates, Green Cards, Import Export code (IEC), Export Declarations and monitoring the operation of the units as a part of single point service to the industry.

\textsuperscript{13} In 1991, government had liberalized various policy measures and simplified different procedures for software development in the domestic territory. For the first time, companies having 51 per cent foreign equity were permitted for software development in the country. Earnings from software export were
policies and providing all support (including fiscal benefits), the availability of high-speed data communications and infrastructure, besides ensuring an almost red tape-free system. The Government, in fact, has granted the velvet-glove treatment to this industry. But the much-needed initiative to develop technological competence for long run sustainability of this industry has not yet been taken place. It is the technology, which plays a critical role for sustainable development of IT industry, rather than the physical infrastructure. Though IT as an industry has received its due share of attention, infrastructure has not been viewed separately as a technological issue.

Software Technology Parks with their modern infrastructure and other policy packages might have helped increasing export earning in the existing types of product and services. The apparent success of STPI has to be examined from the perspective that it has probably helped consolidation of Indian competence on ad-hoc basis and in the wrong direction. In near future it may turn out that India has traded the long-term advantage for short-term gains, which again raises the sustainability issue for the future.

1.5 Research Question and Plan of the Thesis

Our review of the literature suggests that the problem of software industry is more deep-rooted than has been expressed by the above studies. It is clear from the literature that Indian software industry has been characterized as low value / low risk / low investment activities. Given this characteristic of the Indian software industry, the primary aim of our research is an in-depth study of the industry in the light of the present export boom of the software service sector. The study seeks to examine the growth exempted from income tax under Section 80 HHE of the IT Act. Software exporters were also given entitlement for EXIM Scrip for an amount equal to 30 per cent of net foreign exchange earning. Government also announced a scheme for acquisition of software companies abroad by Indian software exporter with 250 per cent export obligation.
sustainability of Indian software industry. Or in other words, this study finds out conditions under which:

- **The growth of software sector will sustain in future**
- **Global supremacy of software industry can be achieved**

In order to examine the growth sustainability and emergence of software superpower of Indian software industry, we would first look at theoretical insight of sustainable growth. In chapter II, various theoretical issues are discussed to find out the conditions under which the growth will be sustainable. In the subsequent chapters, various issues of the Indian software industry have been examined in the light of the conditions of sustainability derived in chapter II. Most of the problems identified in the previous studies of Indian software industry are actually hidden in typical technical jargons of the industry. An attempt is made in chapter III to understand the software industry in terms of general economic terminology. We felt it necessary for a better understanding of the software industry and also for deciphering the missing link between software and hardware segment of IT industry of India. With this understanding we also discuss the features of the products and services offered by the Indian software industry. Our intent is an in depth study of Indian software industry in the light of technical change, innovation and learning. We focus on industry structure and manpower to assess the characteristics of the industry in due course. In chapter IV, we present the structure of the Indian software industry and argue that the structure of industry is a direct consequence of the export centric product and services offered by the industry. Chapter V attempts to assess the quality of manpower that is required to support present activities of Indian software industry. In chapter VI, we investigate how venture capital based
financing assists Indian software firms to grow by innovating new products in high
technology area. The final chapter discusses the policy implications and options in the
light of the findings in earlier sections. It also presents summary and broad conclusions of
the study.