EXPORT COMPETITIVENESS OF SOFTWARE INDUSTRY IN INDIA

Thesis submitted to the Cochin University of Science and Technology
for the award of the Degree of
DOCTOR OF PHILOSOPHY IN APPLIED ECONOMICS
Under the Faculty of Social Sciences

By

HECTOR J THAYIL KOCHUKUNNEL
Reg No: 1902

Under the Supervision of

DR. P. ARUNACHALAM
Head, Department of Applied Economics

DEPARTMENT OF APPLIED ECONOMICS
COCHIN UNIVERSITY OF SCIENCE AND TECHNOLOGY
KOCHI – 682022, KERALA

MARCH 2006

DEPARTMENT OF APPLIED ECONOMICS

COCHIN UNIVERSITY OF SCIENCE AND TECHNOLOGY

KOCHI - 682 022, KERALA, S. INDIA

No. AE.

Phone : 0484-2576030

Certificate

Certified that the thesis ***"Export Competitiveness of Software Industry in India"*** *is the record of bona fide research work done by Mr. Hector J Thayil Kochukunnel under my supervision and guidance. The thesis is worth submitting for the award of the degree of Doctor of Philosophy in Applied Economics (Commerce) under the Faculty of Social Sciences.*

DEPT. OF APPLIED ECONOMICS
COCHIN UNIVERSITY OF SCIENCE & TECHNOLOGY
COCHIN-682 022

Dr. P. ARUNACHALAM
Head, Department of
Applied Economics
Cochin University of Science
and Technology,
Kochi - 682 022

Kochi - 682 022
14th March 2006

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INTRODUCTION

For centuries, India has been a dreamland for navigators to reach in. Trade with India had been frenzy for the rulers of different landscapes. The traces of that great interest in trade with India could be seen in many historical and religious texts. For centuries, India has been the epicenter of global trade. However, of late, the profile of India as the economic resource centre has undergone considerable change. It has been started viewing India as an impoverished nation. This image continued to exist till the 1990s. While India was still suffering from abject poverty, epidemic, grave social inequalities, massive unemployment and destructive political upheavals and uncertainties, a latent revolution has been underway in India's technological landscape. India has now been recognized the emerging capital of global software industry. The Indian software industry and export have been projected as one, which could address all of India's chronic development ills.

India, the world's largest democracy and home to over one billion people, is quietly but quickly emerging as a leader in the field of software engineering. India, one of the poorest countries in the world, better known internationally for its uncompetitive industries, has come a long way with its high growth software industry. India's competitiveness and productivity/effectiveness are not recognized by the nations. However, having recognized its mastery over software production, policy makers

started pinning a lot of hope on the capability and potential of this sector in taking India to the front stage of rapid development.

The competitiveness in international trade has, nowadays, acquired a lot of strategic importance. The most powerful nation is not necessarily the nation with the most potent military backup but a nation with economic muscle. Here comes the strategic importance of international trade. India is more known for its software exports, than the domestic trade. The people from all walks of life are now recognizing the importance of software export and its competitiveness, for facing challenges from other parts of the world by which it can address India's balance of payment deficits, technological backwardness, retarded growth of the economy and unemployment.

1.1 RELEVANCE OF THE STUDY

In this study, the researcher attempts to go into the greater depths of India's software industry domain. Software industry in India concentrates its efforts more on exports. India is becoming a major software exporter. This is a country which offers cost-effectiveness, great quality, high reliability, rapid delivery and, above all, state-of-the-art technologies in software development. The profile of the software development and application by Indian vendors attracted the clients from all parts of the world. It is, in this way, significant to understand the future prospects of this sector.

It is emphasized in many theses that one of India's advantages in software business is its large pool of technically skilled human resources which is available at low cost. However, many developing nations with

sufficiently large pool of human resources are striving to make their mark on the map of global software industry. Hence, India may not be able to boast off her competitive advantage in software industry for long. Studying this aspect is important in terms of the sustainability of this industry and export.

Many have pinned their hope in the transformation capability of this sector on the Indian economy. However, much of it depends on how this sector, especially the exports enables itself to innovate and face competition in this highly dynamic society. Hence the study on export competitiveness deserves merit.

Its export driven model now commands the world's attention for skilled professionals and offers hope to many developing countries which are struggling to cope with a hyper-competitive post-WTO global economy. How India stands in this kind of a battleground is considered to be crucial.

This is a kind of topic, which attracts the attention of policy makers and the government. The software industry and its earning capacity for foreign exchange have definitely a larger bearing on India's economic future. However, studies of serious outlook and a systematic approach are hardly seen before the government in order to take vital policy decisions and measures.

This study was motivated by the need to understand factors that guide the software exports and competitiveness, both positively and negatively. The influence of one factor or another upon the export and export competitiveness is to be understood in great depth which is

necessary to find out the industry's sustainability. It is also important because the strategic loopholes could be identified so that the remedial measures shall be advocated.

A large number of problems or factors, which curtail the prospect of Indian software industry and export, have been spelt through a number of studies. The devastating capabilities of some of them are much bigger than the others. This study aims to identify such problems.

1.2 HISTORY

Technological revolutions, in most circumstances, have far-reaching effects. For some, it may be a life and death problem. But for most countries, it brings out a number of opportunities. Some of these opportunities are unexpected. One such opportunity was availed when India has recognized that it can derive many advantages in computer and software industry. India's success at software has led to speculation about whether other developing countries can emulate its example, as well as whether this constitutes a competitive challenge to software industries in the developed world. In this scenario, it is thoughtful to understand how this nation has been making its voyage in software industry in the context of rough weathers and severe bottlenecks.

India has had a software policy since 1970. Prior to 1984, rigid policy restrictions ensured that there was virtually no software industry. Between 1984 and 1990, the restrictions were eased and Indian firms entered the global market by providing low-cost programming services. After 1990, pro-

active promotion of the industry, along with economy-wide policy liberalization, led to rapid growth in exports. The nature of exports also changed from providing programming services at client sites, to providing offshore services from India for turnkey projects demanding a wider range of capabilities. (Parthasarathy, 2004).

Before 1984, the policy initiatives were very restrictive in nature. In 1977, the Indian government refused to allow more than 50 per cent ownership by foreigners of any company operating in the nation. IBM refused to sell majority ownership of its Indian operations, and was thus forced to leave India. Later, after 1984, the then Prime Minister Rajiv Gandhi changed government policies to encourage an indigenous microcomputer industry (Singhal and Rogers, 2001). Imports were liberalized, and international standards were followed by Indian computer manufacturers so that their products could compete more effectively in the global market place.

During the initial phase of computer software industry in India, many constraints had to be addressed by itself. These constraints include access to finance and skills, a low level of research and development, access to telecommunications and other infrastructure, access to markets and information about markets, and low demand and high piracy in the domestic market. The firms have had difficulty in various types of capital. Software is moderately capital intensive and very highly technology intensive (Cleetus, 1984). Small firms have been particularly affected by the problems of

access to finance since, unlike the largest companies, they do not have access to capital from multinationals or the big sized Indian firms.

Another bottleneck experienced by the firms has been the lack of high skilled manpower. The relative lack of skilled labour is the most serious constraint to the Indian software industry's development (Singhal, 1988, Tandon et al, 1990 and Schware, 1992). Although there has been a shortage of all type of labor, it has been the shortage of the higher-skill levels – programme designers, system analysts, project managers – that has particularly affected this industry.

Software companies, especially exporters, faced a number of telecommunications problems, including the scarcity of actual telecommunications links, delay in obtaining such links, poor transmission quality, and the high cost of installation and use. As a result, overall growth of Indian software exports was stunted, and offshore software development viewed by many foreign clients as unacceptably problematic (Heeks, 1996).

There has been another major problem in the form of market and marketing issues. The ability to monitor and interpret market and technical changes and spot opportunities and shift strategy is vital but beyond the capacity of most individual firms (Sridharan, 1989). This is one of the major reasons behind the low level of software package exports from India, though lack of market information also makes it difficult for software service companies to locate clients or assess potential partners, and for all companies to keep up with the latest software production technology.

The Department of Electronics (DoE) was the body responsible for policy making for the computer industry. But later on, Computer Policy of 1984 eased the availability of microcomputers and facilitated software exports by encouraging on-site service provision. (Parthasarathy, 2004). The 1986 Software Policy encouraged foreign investment in the industry and access to technological development overseas, by allowing easy imports of the latest software and software tools.

While the 1984 and 1986 policies mainly removed hurdles before the industry, positive promotion came in 1990 when the DOE initiated the Software Technology Park (STP) scheme. The Software Technology Parks of India (STPIs) provide data communication facilities using which firms can provide offshore services from India instead of being limited to on-site provision.

In 1988, the industry also formed its own trade body, the National Association of Software and Services Companies (NASSCOM) to promote its interests. When it was formed, NASSCOM had 38 members who accounted for 65 percent of the industry's revenues. A decade later, it had 464 members, accounting for 95 percent of industry's revenues (Parthasarathy, 2004).

The infrastructure in IT took of gradually following the Prime Minister's 1998 IT Task Force and its 108 recommendations, two-thirds of which saw the light of the day. And series of policy changes, and the 2001 Convergence Act which spoke little of convergence but did replace the 1885 Telegraph Act, with its separate rules for voice and data. And the

convergence of the telecom and IT ministries happened in 2001. All that it needed was for the government to step out of the way (Roy, 2002).

In November 2004, the government announced its Broadband Policy and permitted use of 2.4 GHz in out door locations, (Dataquest, 2005 a). From Rs. 3,455 crore turnover in 1992-93, the Indian IT industry grew to mammoth size of Rs. 1, 24,122 crore turnovers in 2004-05. The exports alone grew from a mere Rs. 931 crore in 1992-93 to Rs. 81,096 crore in 2004-05. (Dataquest, 2005 b)

Under this subtitle we have seen the emergence of software industry in this nation, the major bottlenecks, which had been experienced by this sector, and the major turning points, which boosted this industry in becoming a globally competitive software industry in the world today.

1.3 LITERATURE REVIEW

Software industry shall be said comparatively to be a young industry, if not infant, especially when compared with industries like mining, textiles etc. It has to be specified that this industry is even younger than computer industry. In erstwhile times, software has been clubbed with hardware and/or electronics and so software industry has been a constituent of the larger spectrum of electronics and hardware industry. As this being the case, authoritative literature on India's software industry and its competitiveness is scarce and deficient in number, if not nil.

Kaplinsky (1987) had examined the impact of information technology on the economy of developing nations. He clarified that information

technology is one of the most crucial technologies influencing economic growth in developing countries. Bhatnagar (1992) had also opined on similar lines. A World Bank study (1993) specified that software had become the 'lifeblood' of business, industry and government. Narasimham (1984) in his work had specified about the need for developing nations embracing local software industry. Fialkowski (1990) and Schware (1987) expressed the necessity for developing countries to awake to build its own software industries to keep momentum of the economic growth.

"In developing countries interest in both the production and the use of software is becoming more intense" (Schware, 1990). Two writers (Schware 1987, Correa, 1990) talked about policy guidelines on software. But authors like Heeks (1996) criticizes that their policy guidelines were not set within the larger industrial policy framework.

Kohli (1991) expressed that there had been an overwhelming preoccupation with software exports to the detriment of a viable domestic software industry. Raman (1985) stated that despite the growth of package sales and data entry services, Indian software exports have been dominated by export of software services, in the form of custom software work rather than export of software products, in the form of packages.

There were many studies, which looked into the break-up of India's software exports ie; destination of software exports. Lakha (1990) asserted that the export market was regionally concentrated, with a heavy reliance upon the U.S.

Size mattes when it comes into the software firms. Schware (1989) points out that the main advantage of small firms' presence in the industry is its ability to act quickly in order to exploit market niches. Cooper (1983), Saldanha (1983) and Sen (1995) expresses that there was a need for a focus on the medium and large firms, at least in exports, because they offer greater certainty of growth, they take advantage of scale of economies and bargain strength that small companies do not have, and they face fewer entry barriers.

Some studies pointed that staff turnover was a major problem for software companies. Mukhi and Chellam (1988) expressed that in the world of software exports, since there are no tangible assets being exported, the loss of men or brainpower can be the biggest loss that computer companies face.

There are studies, which talked about the problem of brain drain faced by India. Sivakumar (1990) noted that India's total brain drain losses between 1985 and 1990 estimated to have cost the country as much as US $ 13 bn.

Lanvin (1991) expressed that one of the areas in which competition is likely to be fiercer than anywhere else is software market. D'Costa (2000) clarified that broad economic reforms are compelling Indian business to respond to increased competition.

Low staff cost is found to be a major advantage, which India has. Moore (1992) and Nicholas (1994) examined that salary costs in the UK

were four to five times higher than those in India, while those in the US were six to eight times higher. Software salaries in Russia were roughly twice as high and those in Singapore were about three times higher (Meadows, 1994; Zachary, 1995).

The US market dominates Indian software exports partly because it is by far the world's largest software market, constituting around half of all software sales in the late 1980s and 1990s, and partly because 'American information technology and financial services companies have moved much more quickly than their European counterparts to take advantage of offshore programming (Tilley, 1990).

There are studies about the productivity, competitiveness and job opportunities as directed by Indian software industry. Mehta and Reilly (1992) and Crabb (1995) specified that it seemed likely that the gap between demand and supply of software could continue to grow both in the West and India. Regarding skills requirements, Cane (1987) and Hemnes and Di Paolo (1995) noted that the main skills bottleneck for the Indian software industry is not a shortage of programmers to write programs but a shortage of quality analysts able to decide what a business was all about and how best to represent it in computing terms.

Issac, Rajendran and Anantharaman (2003) have concluded in their study that quality has gained acceptance as a key factor that helps organizations to achieve success and competitive edge in the global market. The said study confirmed that the quality certified firms (inclusive of ISO 9000 certified and CMM highly rated firms) have better product attributes

(PAs) and return on quality (ROQ) than the non-certified firms. It has also been observed that there appears to be no difference between non-certified firms and ISO certified firms, whereas the CMM highly rated firms are better than non-certified firms and ISO certified firms with respect to both the performance indicators. Corbett et al (1998) told that quality management has been reckoned as the prime mover for enhanced business performance. Sun (2000) endorsed that strategic management of quality and human resources is significantly correlated with performance improvement. Jorgensen (1999) stated that software quality can be indirectly measured and/or predicted with the help of characteristics like maintainability, usability, portability, reusability etc.

Ahmad et al (1992) have expressed that the decrease in the number of local packages and that, mainly because of imports, 'local players have lost a major chunk of the domestic market and more Indian software vendors are now dealing in foreign products'.

There is literature on the role of government policy on software industry. The researcher could go through Page (1987). The author felt that government policy has not been decisive in guiding collaboration decisions. Dicken (1992) asserted that the actions of nation states form the most important element of the environment within which transnational corporations operate.

Singhal (1988) and Tandon et al (1990) opined that the single most important input to the software production process is skilled labour, but

equally that the relative lack of such skilled labour is the most serious constraint to the Indian software industry's development.

Many argue that newly industrializing economies would be in danger of losing their competitive edge based on labour (Ernst and O'Connor,1989; Hurtado,1985 and Porter,1990) . There are already signs that multinational corporations are moving their offshore operations, which were profitable in some developing countries mainly because of the relatively low cost of both unskilled and skilled labour back to home country as automation makes it possible to reduce cost even more. This means that in the future, developing economies will not be able to rely solely on cheep labour and intermediate technologies for their economic growth, as did Newly Industrialized Countries (NIC).

D'Costa (2004) discussed about the Indian software industry in the global division of labour. He delineated three forms of decoupling of the software industry in India. Those are

a) Decoupling the software industry from the larger hardware sector.

b) Disconnecting the industry from the domestic market, and

c) The specialized division of software into services and products.

He argued for urgent steps to extricate the software industry from its low-end trajectory. He reiterated the need for the resolution of the three disconnections by leveraging the domestic economy for export competitiveness and balanced home development.

Sridharan (2004) studied the recent evolution and future trajectory of the Indian software industry. He cautioned software firms continually reinvent themselves or incrementally adapt to challenges, both of which are essential for them.

Dorfman (1987) put forward the argument that appropriation of technological benefits via rapid moves down the learning curve and gains lead-time over rivals is a hallmark of an entrepreneurial technological regime.

Brunner (1995) has had a thoughtful and explorative study on the details of technological change which happened in India's computer industry .He went on to discuss the reasons why economies like India will, in future, have to close the technology gap in microelectronics and communications technologies in order to improve their performance and increase their industrial competitiveness.

Parthasarathy and Joseph (2004) have studied about the innovation under export orientation. They claimed that there appeared to have been hardly any attempt towards enhancing the innovative capability of the firms to enable them to move up the software value chain.

Avnimelech and Teubal (2004) analyzed the Indian software industry from an Israeli perspective. They analyzed a number of aspects such as Israel's high tech sector and cluster, innovation and technology policy, three Indian IT companies, the prospects for Indian IT and possible policy implications.

Krishnan and Prabhu (2004) studied software product development in India. The researcher analyzed six cases with particular references. Singhal and Rogers (2001) discussed the evolution of technology and technology industry including information, communication and software industry 'from bullock carts to cyber marts'. They analyzed India's communication revolution, the public broadcasting revolution, the private television revolution, rising technopolises, the telecommunications revolution and the computer and Internet revolution.

Kattuman and Iyer (2001) discussed about a number of implications of India's softwate industry. They also talked about the phenomenon of decoupling of software export markets from the domestic market.

Saxenian (2004) studied about the transnational networks and regional development in Taiwan, China and India. The author made clear the important jargons like technical communities, industrial decentralization etc. He referred China as a case of reversing brain drain.

Basant and Chandra (2004) studied capability building and inter-organization linkages in the Indian IT industry. Authors say that convergence of technologies is creating newer opportunities for inter-firm alliances. Kanter, Kao and Wiersema (1997) argue that there is a need for an organizational climate which helps in overall business performance. Wheelwright and Clark (1992) argued a development strategy that chooses the right set of projects and helps integrate strategic planning with R & D strategy.

Ojha and Krishna (2004) analyzed on the subject of originative innovation and entrepreneurship in the software industry in India. They strongly argued for the promotion of entrepreneurship in the Indian software industry. Bhatnagar and Dixit (2004) studies stages in multiple innovations in software firms. It could be understood that different stages are involved in multiple innovations in software industry.

The researcher also surveyed a very popular and useful journal 'Dataquest'. The researcher could go through and analyze all issues of 'Dataquest' right from January 2002. Some important references from the said journal could be quoted in other chapters. On account of the problem of abundance, no references of 'Data Quest' could be detailed under the title 'Literature Review'.

It is also to be clarified that appropriate references available about the literature are quoted in other chapters.

1.4 STATEMENT OF THE PROBLEM

India is being emulated as an example for the success strategy in software development and exports. Many scholars as well as industry experts claim that the sector can answer to many of the problems of chronic ills of India's backwardness. India's software industry is hailed as one of the globally competitive software industries in the world. India has been given number one rank in terms of attractiveness as shown by many attractiveness indices (AT Kearney, 2004)

In this study, the researcher made an attempt to endeavour a comprehensive look at the competitiveness of India's software industry. Indian software and services industry and exports are bestowed with a number of merits and positive strengths. India is cited as a hub of one of the world's largest and most talented human resources, a large number of English speaking skilled labour which, in turn, is a natural advantage which is in consonance with the needs of industries of the developed world, and of course, a comparatively early preparedness of this country in the field of hardware and software expertise. Even when this being the case, it is finding it difficult to answer to a number of fundamental questions aroused by the realities of today and concerns about the future.

Is India really worthy of being at the front stage of the global attractiveness of software industry? Are the preparedness, strengths and policy orientations of future really help to sustain with at least the present scale of competitiveness? Could Indian industry outsmart the extent of competition posed by players like Ireland and Israel? Is the level of physical discrepancy in turnover between domestic software sales and exports helping the cause of competitiveness? What are the problems of software industry and exports, which are to be addressed with urgency and a time scale? What is the degree or extent of impact each factors have upon the sectoral performance? This study tries to seek answer to all the above questions.

India and its software sector enjoy plenty of natural advantages. It is also to be categorically specified that it is devoid of many of the strengths

the developed world has. In this background, the problem is whether India is competitive enough to face challenges from other dominant players as well as contingencies of future? This study discusses how India places itself in the trajectory of global competitiveness of software industry and exports.

1.5 OBJECTIVES

The following are the major objectives:

1. To model the growth pattern of exports and domestic sales of software and services of India.
2. To find out the factors influencing the growth pattern of software industry in India.
3. To compare the growth pattern of software industry of India with respect to that of Ireland and Israel.
4. To find out the criticality of various problems faced by software industry and export in India.
5. To model the variables of competitiveness of emerging software producing nations.

1.6 HYPOTHESES

Based on an extensive and detailed survey of literature and key interactions made with the think-tank in software industry and academics, six different hypotheses were formulated on the following lines:

1. The difference in rate of growth in turnover between the domestic software sales and software export is more or less constant.

2. The export competitiveness of software industry in India is not governed by any specific factor/factors.

3. The three emerging software exporting nations- India, Israel, and Ireland – follow almost similar pattern in their export turnover and competitiveness.

4. The guiding variables of software industry in India are independent irrespective of the size/turnover of software firms.

5. The governing criteria, which guide the software export and its competitiveness, are independent in nature.

6. In terms of competitiveness, India's position in global software industry domain is neither lucrative nor lukewarm.

1.7 METHODOLOGY

Both primary and secondary data have been used in the study. No specific geographical delimitation is made into effect in this study on account of the peculiarity of the topic. Since the export competitiveness is the primary area of interest, the data of both India and international economies have been taken into account. The major sources of secondary data are international reports, websites of national and international software export promotional agencies like National Association of Software and Services Companies (NASSCOM), research and commercial

establishments and reputed journals like Dataquest. When developing models on software success guiding factors, primary data have been resorted to. Both face-to-face interview and online survey based on a structured questionnaire were employed to collect primary data. In order to fix the sampling size a pilot study has been carried out. No specific study sampling procedure could be employed because of the peculiar nature of the industry and professionals. In order to make sure that all the different sections of the population are duly represented, a large sample size has been taken. Total sample size 1089.

1.8 TOOLS USED IN THE STUDY.

The data collected through primary and secondary sources were scrutinized and statistical software viz; AMOS (Analysis of Moment Structures), SPSS (Statistical Package for Social Sciences) and E Views (Econometric Views) were used for analysis. The following tools have been employed for the purpose of analyzing the data and at arriving at inferences.

- Different Simple Linear Regression Models were used to model India's software export and domestic sales as well as the export of Israel and Ireland.

- Panel Auto Regression Analysis has been applied to model and compare the software export performance of India, Israel and Ireland in combination.

- Analysis of Variance (ANOVA) has been used to identify the impact of different factors upon software industry and export.

- Multi- Dimensional Scaling (MDS) is used to identify similarity/ dissimilarity among different factors which guide software export.

- Structural Equation Model (SEM) has been used to measure the relationships between eleven factors, which guide software export.

- Canonical Correlation is used to find the extent of correlation between different variables of competitiveness.

- Principal Component Analysis (PCA) has been used to ascertain the position of India in the competitiveness ladder.

1.9 LIMITATIONS OF THE STUDY.

- A standard sampling procedure could not be adopted due to the specific nature of the industry.

- Secondary data could be more resorted to rather than primary data because of the nature of the study.

- Since software industry and export are an emerging and dynamic field of economic activity and that the rate of change is so rapid, the relevance of individual factors may change over time.

1.10 CHAPTER SCHEME

The study is presented in Seven Chapters. Chapter 1 describes the relevance of the study, statement of the problem, history, literature review, objectives, hypotheses, methodology and limitations of the study. Chapter 2 elucidates low profile domestic software. Chapter 3 compares the export

performance of India, Israel and Ireland on a panel auto regressive model. Chapter 4 reviews factor impact and firm size based on primary data. Chapter 5 deals with the building of a software export guiding factors model. Chapter 6 reviews the positioning of different countries on attractiveness scale and builds India's position in competitiveness ranking. Chapter7 presents the findings of the study, suggestions for improvement and conclusion.

Chapter

2

LOW PROFILE DOMESTIC SOFTWARE MARKET

LOW PROFILE DOMESTIC SOFTWARE MARKET

2.1 INTRODUCTION

India's software sector manifests itself as a unique case of proven success and national pride. It displays many unusual features in the context of a historically mediocre growth pattern of Indian economy and its export domain. A vivid manifestation of this is the fact that it is considered to be the sole arena where India is recognized as one of the vital players. Academicians and experts in industrial community alike consider India as the global IT superpower. Its export orientation is another unusual feature, accounting for 65 percent of the total software revenue. The story of Indian success at software brings out speculations whether other developing countries can emulate its example. The emergence of India as a source of software expertise was firmly established when a World Bank funded study in the US confirmed that foreign vendors rated India as their number one choice for software outsourcing (Mehta,1999) .Software and services export constitutes a substantial chunk of total production compared to relatively a low domestic software market. This chapter aims at studying the disproportionate nature and gap between its export and domestic sectors and also finding out reasons behind low domestic revenue and suggesting remedies to cure the ills at the domestic front.

According to a report prepared by India's IT Task Force, the country's software industry could earn annual revenues of more than US $85 billion by the year 2008, comprised of US $50 billion in software exports and

almost US $ 35 billion in domestic software sales (Mehta,1999). Grasping over revenue figures of IT from 1981-82 onwards, the space between the two is widening in the years that go by. Considering the wide range application of IT products and services in advanced industrial societies, to which India exports mostly and low degree of such an application in many an archaic sectors of national economy, this deviation does not seem to be an aberrant one. The nature of national economy and international economies, thus gives the most fundamental reason for this discrepancy. The application of information technology is the basic requisite for any knowledge society. India's IT exports have been to such post-industrial or knowledge societies. Post-industrial society is one where knowledge has displaced property as the central pre occupation and the prime source of power and social dynamism (Bell, 1976).

An analysis of major software destinations gives an impression that most of the importers of Indian software and services including IT enabled services/BPO comes under Bell's description of post-industrial societies. The evolution of societies and transformation of national economies to more and more advanced ones, thus came to be the first causative mechanism contributed to the export of software to international economies. In contrast, the under developed nature and meager rate of technological revolution at the domestic front resulted in low application and use and a low software sales.

2.2 NATURE OF INDIAN SOFTWARE AND STATUS OF DOMESTIC AND EXPORT MARKET

Many a difference between the export market and the domestic one are qualitative. A major difference relates to the different types of software developed Fig.2.1 and Fig 2.2 show that software sector sells different products and packages and also provides a number of services. Turnkey projects constitute more or less 30 percent of both domestic software sales as well as exports. Whereas products and packages accounted for 52 percent of the domestic market, they account for a little under 10 percent of exports. As much as 80 percent exports are software services including custom software development, consultancy and professional services (NASSCOM, 2001). The researcher's field visits indicate that sufficiently a large number of telecommunication firms, banking companies and retail business firms are customers or potential customers for Indian software firms.

In fact, a number of Indian firms are capable of playing big roles in global market. But some major factors that deter their growth are absence of domestic policy support and lack of a competitive domestic market. A competitive domestic market will attract more players and inspire them to produce world class products and packages. Since India has had tremendous inputs for growth and the opportunities are infinite and varied, a strong market within India can give its players a competitive edge in the export front. This signifies the need and presence of a strong and quality domestic market.

But the size of Indian market for its own software is a small one. The domestic software industry has been losing importance relative to exports. In 1990-91 it accounted for 47 percent of total software revenues while exports accounted for 53 percent (NASSCOM, 1996). Over the years the share of domestic market in total software revenue has been declining. Fig. 2.3 shows the contribution made by export market, and domestic revenues.

Figure2.1 COMPOSITION OF INDIAN SOFTWARE DEVELOPMENT AND SERVICES (DOMESTIC)

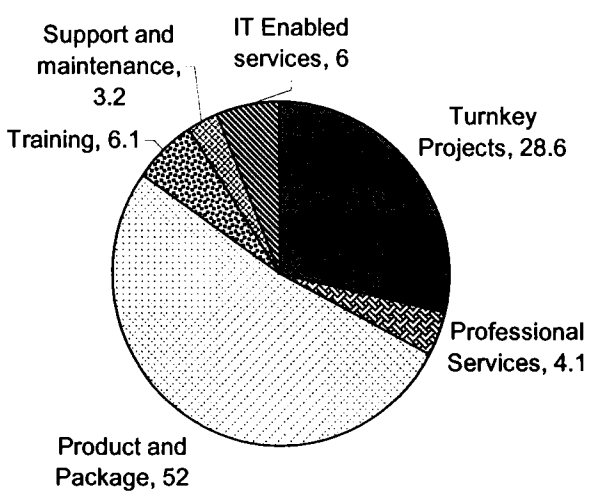


Figure 2.2 COMPOSITIONS OF INDIAN SOFTWARE DEVELOPMENT AND SERVICES (EXPORT)

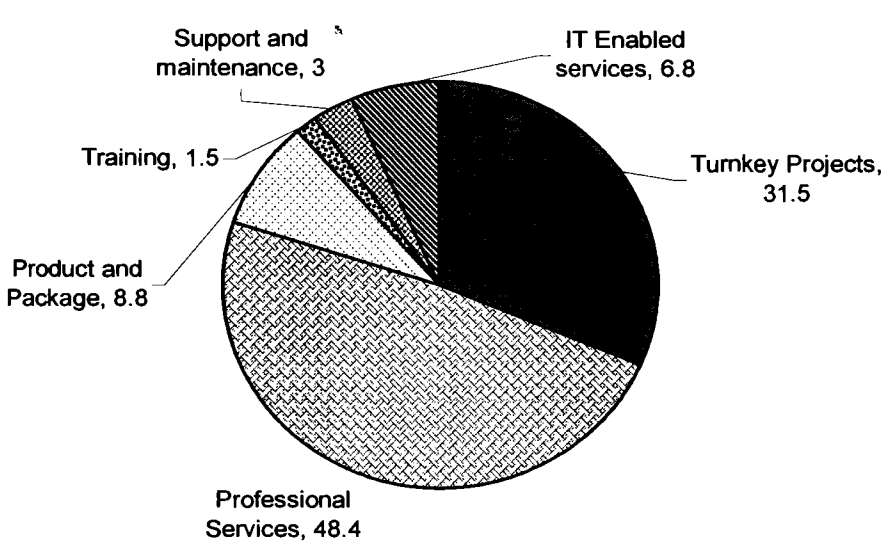


Table2.1: COMPOSITION OF INDIAN SOFTWARE DEVELOPMENT AND SERVICES (DOMESTIC & EXPORTS)

Software Activity	Domestic Software (%)	Export Software (%)
Turnkey Projects	28.6	31.5
Professional Services	4.1	48.4
Product and Package	52.0	8.8
Training	6.1	1.5
Support and maintenance	3.2	3.0
IT Enabled services	6.0	6.8

Source : **NASSCOM**

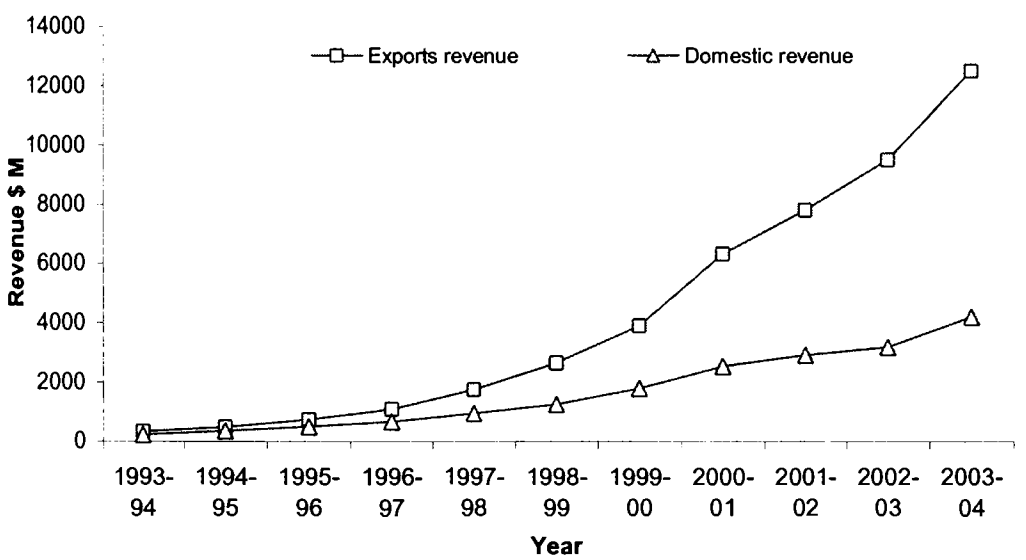
Table 2.2: SOFTWARE REVENUES OF INDIA: GROWTH IN DOMESTIC, EXPORT AND TOTAL REVENUES

Year	Exports in $ M	Domestic Revenue $ M	Total $ M
1993-94	480	227.9	707.9
1994-95	668	350	1018
1995-96	997	490	1487
1996-97	1650	670	2320
1997-98	2180	950	3130
1998-99	3600	1250	4850
1999-00	5300	1800	7100
2000-01	6200	2530	8730
2001-02	7550	2910	10460
2002-03	8800	3170	11970
2003-04	11984	4200	16184

Source : **NASSCOM**

The table 2.2 shows the figures for gross software export earnings .Despite some degree of variation within the exports of the Indian software industry , these have been epitomized by the export of programmers who go to work in the US and other countries for a collaborator on a regularly billed basis

Figure 2.3 INDIA- GROWTH IN EXPORT AND DOMESTIC REVENUES



2.3 EXPORT –A FRONT RUNNER

Indian software export consists primarily of software services. Most of the firms in India are essentially carrying out maintenance tasks for applications on legacy systems such as IBM mainframe computers, development of small applications, and immigration to client server systems etc. Application solutions are the most common type of exports, followed by re-engineering (also called porting) and conversion projects such as Y2K projects (Arora et al, 1999)

The country's software exports were a meager US$ 4 million in 1980. It has risen to 1650 million dollar in 1997-98 (Heeks,1998) Unfazed by the tough global market, the software and allied service industry jumped 30.5 percent to clock a revenue of $ 12.5 billion in 2003-2004, thus becoming the largest exporting segment from India, according to NASCOM (The Economic Times, 2004). But these figures do not convey the real picture. Most of the exports have been to a very few countries. For example, the US continues to be the primary market with the exports constitute about 70 percent of total software exports followed by UK with 15 percent (The Economic Times, 2004) It is thus very convincing that any fundamental shift in their economic and trade policies and substantial changes in diplomatic relations with India can have disastrous effects. The researcher's meeting with IT experts suggest that the remedy lies in diversification i.e., proliferation of more and more export markets and provision of diversified products and services. Moreover, the industry should continue to provide the best of services. Various theses confirm that since the Indian software Industry is a competitive Industry (in the sense that price closely reflects costs rather than customer value). US firms have benefited disproportionately from the services of the Indian software industry (Arora and Arunachalam ,2000)

2.4 DOMESTIC MARKET – THE NEED OF THE HOUR

As stated earlier, in a service economy the application of software systems is widely practiced and necessitated by the advancement in the economic structures. Since India being in a transition stage and not having its own either capitalist or post capitalist variables in its account, IT

requirements are neither promptly employed nor a legacy of modernization found rampant here. Nothing seems propelling a wide range of software applications. It is evident from the share of domestic sector in the total software industry. Out of the $15.9 billion Indian software industry, the domestic sector accounts for a merely $3.4 billion .This study tries here to look into the causative variables behind the poor state of affairs of Indian domestic software sector.

2.5 ECONOMETRIC MODEL FOR SOFTWARE INDUSTRY

Here, the researcher tries to suggest and identify the most suitable model among a number of models. Projection of future course of action with the optimum accuracy is the established goal.

Table 2. 3 INDIA'S SOFTWARE EXPORT, 1980 – 2004

Year	Export $M	Year	Export $M
1980	4	1993	314
1981	6.8	1994	480
1982	13.5	1995	668
1983	18.2	1996	997
1984	25.3	1997	1650
1985	27.7	1998	2180
1986	38.9	1999	3600
1987	54.1	2000	5300
1988	69.7	2001	6200
1989	105.4	2002	7550
1990	131.2	2003	8800
1991	173.9	2004	11984
1992	219.8	2005	

Source **: Richard Heeks, Data Quest**

The first model suggested here is linear model. This is an additive model.

$$Y = a + bt + \varepsilon$$

Where

Y - Export,

t - Year,

a - Intercept,

b -Rate of growth,

and,

ε -error.

Here *a* and *b* are known as the regression coefficients .They are estimated using the principle of least squares. The adequacy of a model is determined by the R^2 value which is also known as co-efficient of determination (Gujarathi, 1995).

The Figure 2.4 represents the export value and the fitted curve.

Figure 2.4 LINEAR MODEL FOR EXPORTS OF SOFTWARE

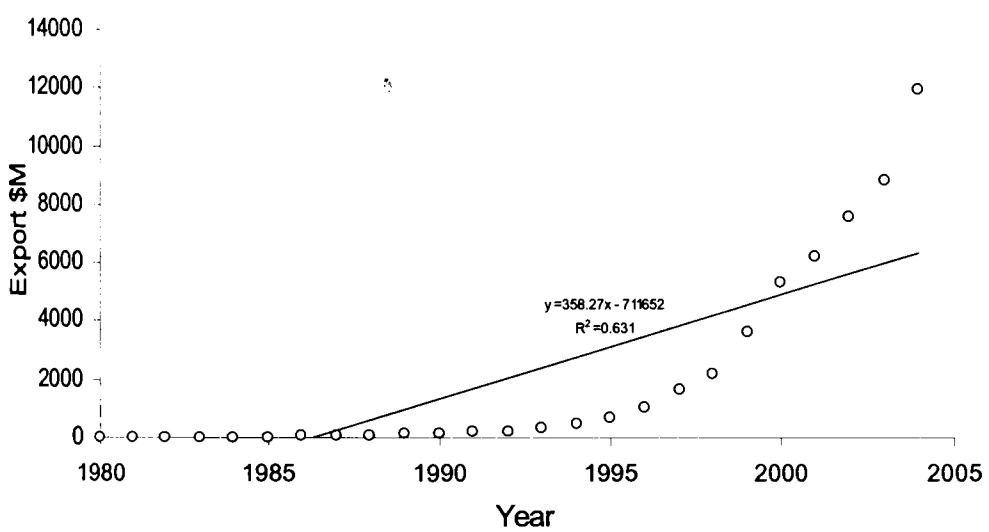


Table2.4 SUMMARY OF LINEAR MODEL

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
Linear	0.794	0.631	.615	2059.770

Table 2.5 ANOVA TABLE FOR LINEAR MODEL

	Sum of Squares	df	Mean Square	F	Sig.
Regression	166865482.370	1	166865482.370	39.330	.000
Residual	97581020.425	23	4242653.062		
Total	264446502.795	24			

Table 2.6 REGRESSION COEFFICIENTS FOR LINER MODEL

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	-711651	113799.214		-6.253	2.22E-06
Year	358.270	57.1277453	0.7943	6.271	2.13E-06

From the Tables 2.4, 2.5 and 2.6, it is ascertained that the rate of growth calculated from the above is 358.27 which can be interpreted that an amount of $358.27 m has been increasing on an average over the years. But the crucial factor is that the R square value is capable of describing only 63.1 percent of the total variation in the export. From the graph, it is vivid that the model has not been capable of projecting the boom in software exports from the year 1995 onwards.

The researcher, for the sake of accuracy and reliability, undertook other major models.

1. Quadratic Model

$$Y = b_0 + b_1 t + b_2 t^2 + \varepsilon$$

2. Cubic Model

$$Y = b_0 + b_1 t + b_2 t^2 + b_3 t^3 + \varepsilon$$

3. Logarithmic model

$$Y = b_0 + b_1 \log(t) + \varepsilon$$

4. Inverse model

$$Y = b_0 + \frac{b_1}{t} + \varepsilon$$

5. Power model

$$Y = b_0 t^{b_1} + \varepsilon$$

6. Compound model

$$Y = b_0 b_1^t + \varepsilon$$

7. S Model

$$Y = e^{b_0 + \frac{b_1}{t}} + \varepsilon$$

8. Logistic model

$$Y = \frac{1}{\frac{1}{u} + boe^{bit}} + \varepsilon$$

9. Exponential Model

$$Y = b_0 e^{bit} + \varepsilon$$

10. Growth model

$$Y = e^{b_0 + b_1 t} + \varepsilon$$

Where Y represents the export, b_0, b_1, b_2, b_3 represent the partial regression coefficients and t, the year.

All the above facts shall be summarized in the tables and figures below:

1. Logarithmic model

$$Y = b_0 + b_1 \log(t)$$

Figure 2.5 LOGARITHMIC MODEL FOR SOFTWARE EXPORT

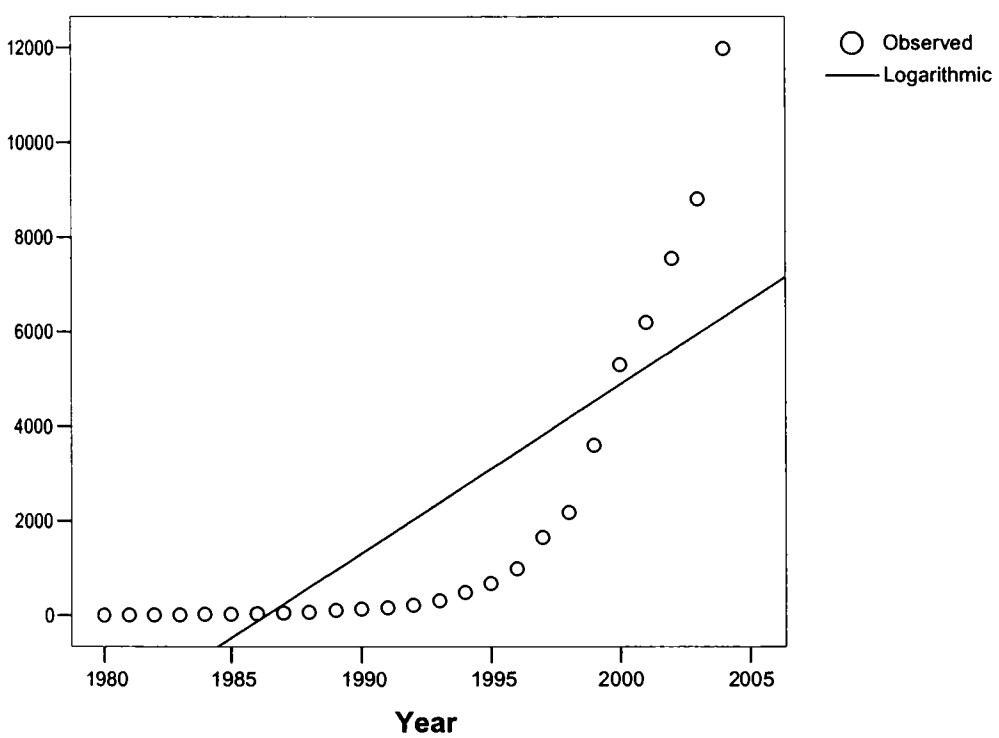


Table 2 .7 SUMMARY OF LOGARITHMIC MODEL

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.793	0.630	0.613	2063.729

Table 2 .8 REGRESSION COEFFICIENTS OF EXPORT ON LOGARITHMIC MODEL

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Year	712865.853	114016.135	0.793	6.252	.000
(Constant)	-5413537.470	866167.892		-6.250	.000

2. Inverse Model

$$Y = b_0 + \frac{b_1}{t}$$

Figure 2.6 INVERSE MODELS FOR SOFTWARE EXPORT

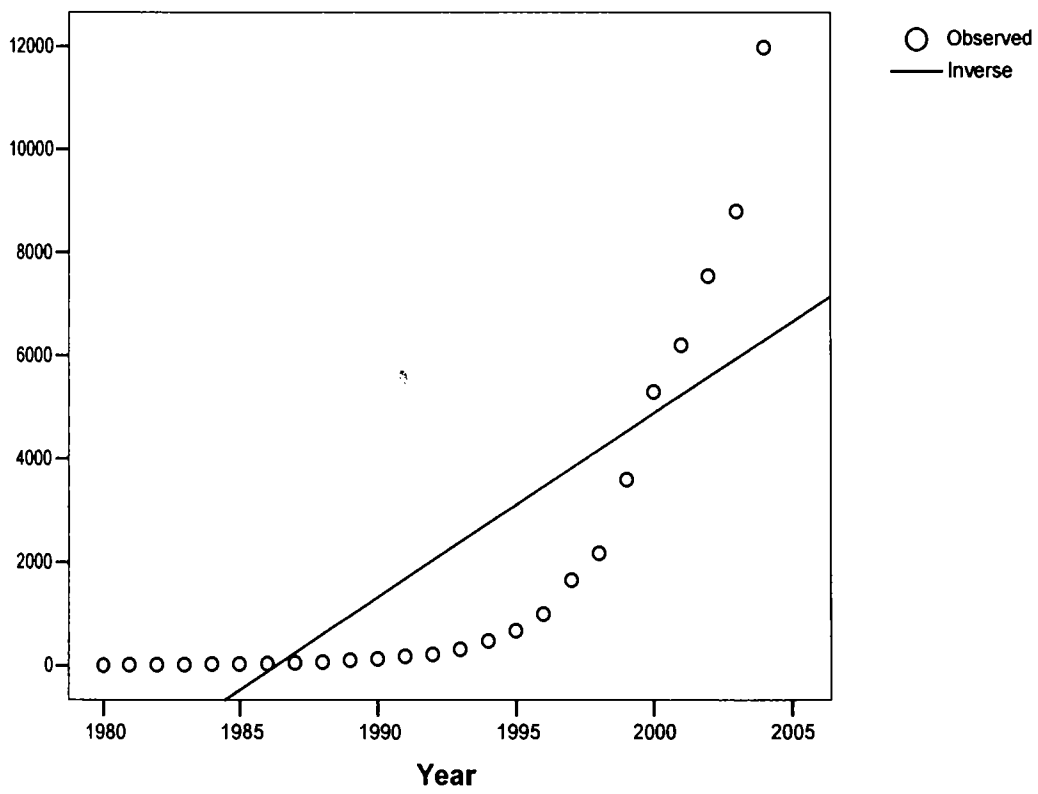


Table 2 .9 SUMMARY OF INVERSE MODEL

R	R Square	Adjusted R Square	Std. Error of the Estimate
.793	.628	.612	2067.681

Table 2 .10 REGRESSION COEFFICIENTS OF EXPORT ON INVERSE MODEL

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 / Year	-1418398496.486	227550634.415	-.793	-6.233	.000
Constant	714081.264	114234.492		6.251	.000

3. Cubic Model

$$Y = b_0 + b_1 t + b_2 t^2 + b_3 t^3$$

Figure 2.7 CUBIC MODELS FOR SOFTWARE EXPORT

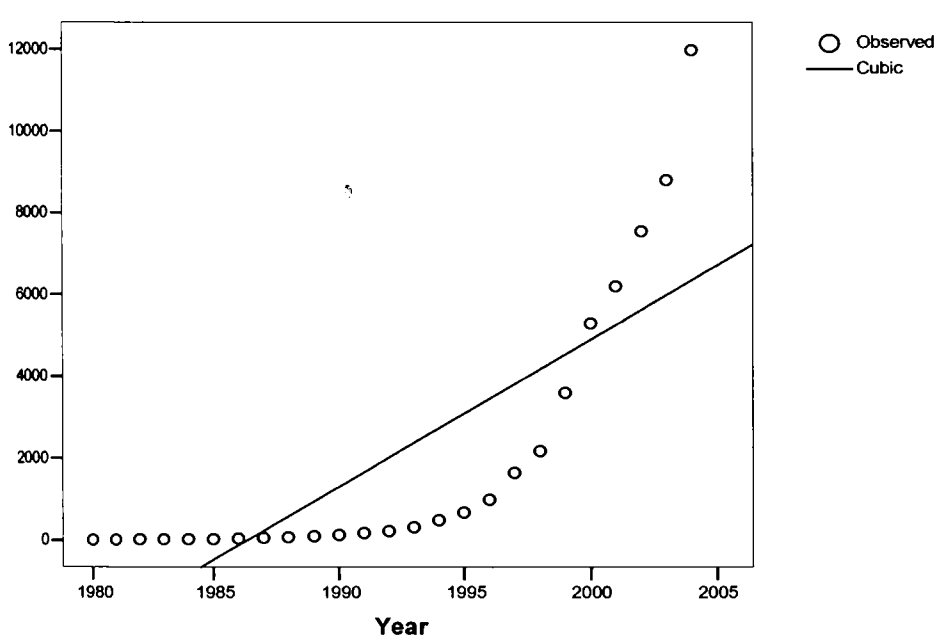


Table 2 .11 SUMMARY OF CUBIC MODEL

R	R Square	Adjusted R Square	Std. Error of the Estimate
.796	.634	.618	2051.834

Table 2 .12 REGRESSION COEFFICIENTS OF EXPORT ON CUBIC MODEL

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Year	3.02E-005	.000	.796	6.310	.000
Constant	-236408.067	37789.883		-6.256	.000

4. Compound model

$$Y = b_0 b_1^t$$

Figure 2.8 COMPOUND MODEL FOR SOFTWARE EXPORT

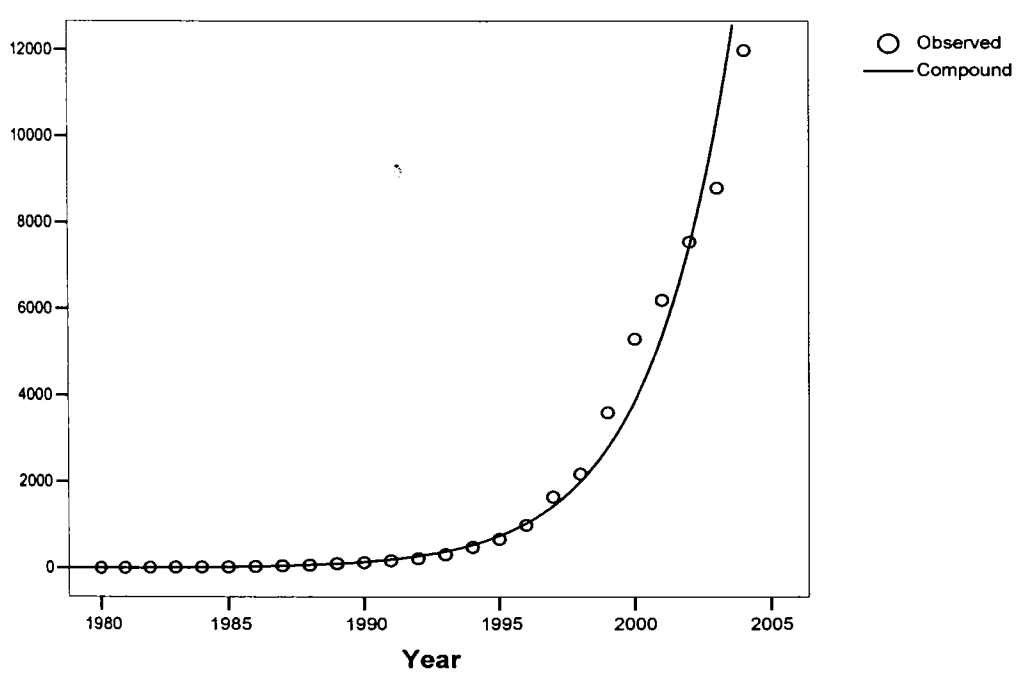


Table 2 .13 SUMMARY OF COMPOUND MODEL

R	R Square	Adjusted R Square	Std. Error of the Estimate
.998	.995	.995	.175

Table 2 .14 REGRESSION COEFFICIENTS OF EXPORT ON COMPOUND MODEL

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Year	1.390	.007	2.712	205.797	.000
(Constant)	3.76E-283	.000			

5. Quadratic Model

$$Y = b_0 + b_1 t + b_2 t^2$$

Figure 2.9 QUADRATIC MODEL FOR SOFTWARE EXPORT

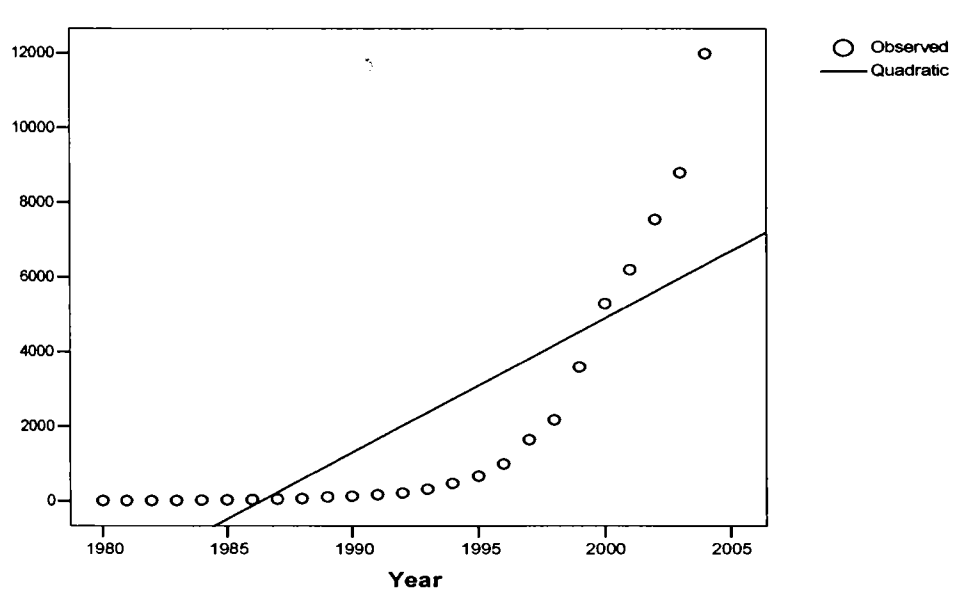


Table 2 .15 SUMMARY OF QUADRATIC MODEL

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.795	0.632	0.616	2055.805

Table 2 .16 REGRESSION COEFFICIENTS OF EXPORT ON QUADRATIC MODEL

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
ln(Year)	712865.853	114016.135	.793	6.252	.000
Constant	-5413537.470	866167.892		-6.250	.000

6. S Model

$$Y = e^{b_0 + \frac{b_1}{t}}$$

Figure 2.10 S MODEL FOR SOFTWARE EXPORT

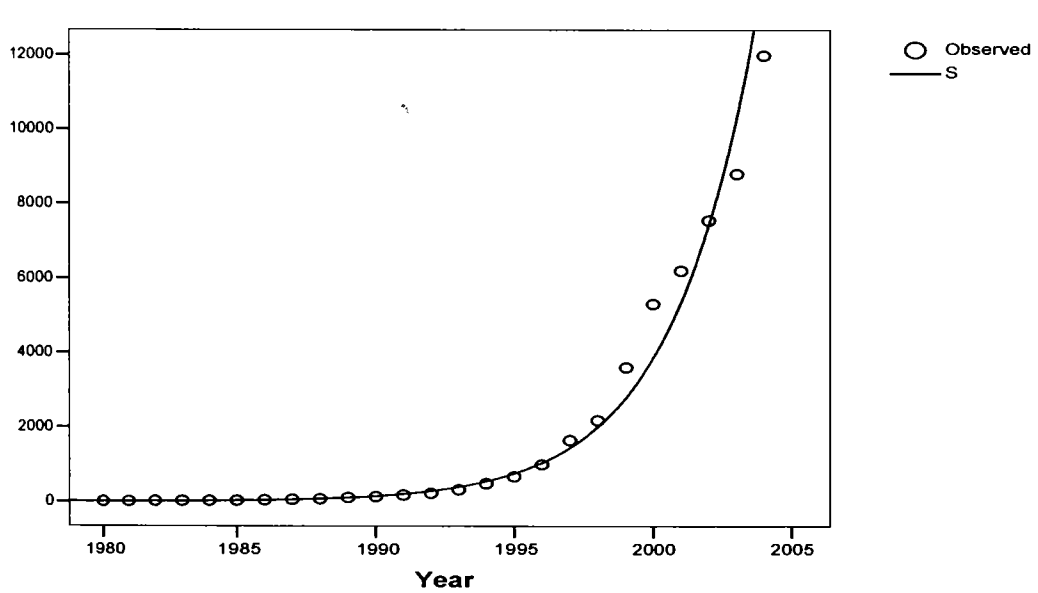


Table 2 .17 SUMMARY OF S MODEL

R	R Square	Adjusted R Square	Std. Error of the Estimate
.997	.995	.995	.176

Table 2 .18 REGRESSION COEFFICIENTS OF EXPORT ON S MODEL

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 / Year	-1306560.094	19349.110	-.997	-67.526	.000
Constant	661.539	9.714		68.104	.000

7. Growth model

$$Y = e^{bo+b_1 t}$$

Figure 2.11 GROWTH MODEL FOR SOFTWARE EXPORT

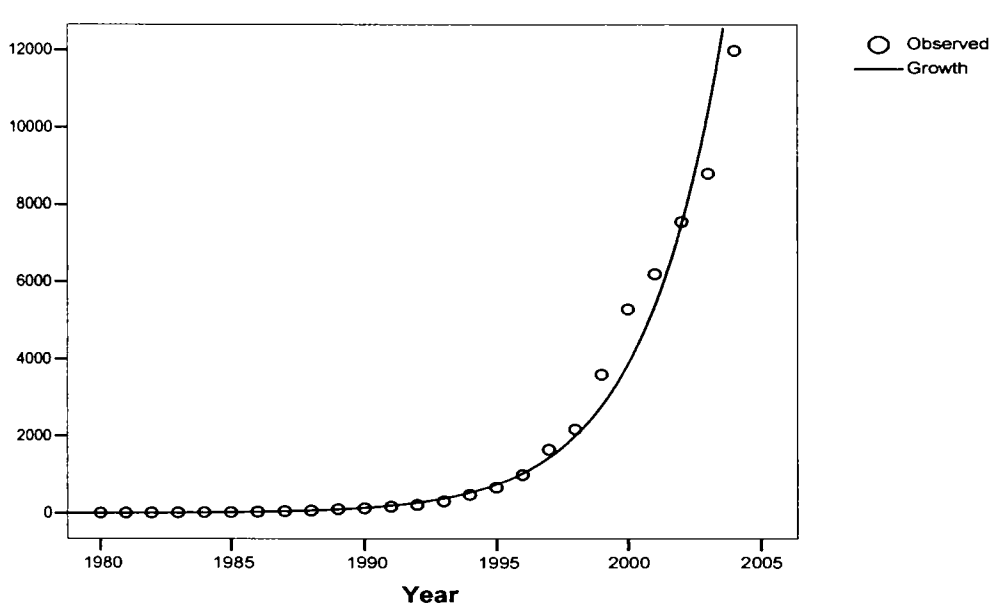


Table 2 .19 SUMMARY OF GROWTH MODEL

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.998	0.995	0.995	.175

Table 2 .20 REGRESSION COEFFICIENTS OF EXPORT ON GROWTH MODEL

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Year	.329	.005	0.998	67.766	.000
Constant	-650.307	9.680		-67.184	.000

8. Logistic model

$$Y = \frac{1}{\frac{1}{u} + boe^{bit}}$$

Table 2 .21 SUMMARY OF LOGISTIC MODEL

R	R Square	Adjusted R Square	Std. Error of the Estimate
.998	.995	.995	.175

Table 2 .22 REGRESSION COEFFICIENTS OF EXPORT ON LOGISTIC MODEL

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Year	.719	.003	.369	205.797	.000
Constant	2.660E+282	2.575E+283		.103	.919

9. Power model

$$Y = b_0 t^{b_1} + \varepsilon$$

Table 2 .23 SUMMARY OF POWER MODEL

R	R Square	Adjusted R Square	Std. Error of the Estimate
.997	.995	.995	.175

Table 2 .24 REGRESSION COEFFICIENTS OF EXPORT ON POWER MODEL

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
ln(Year)	655.923	9.694	.997	67.663	.000
(Constant)	.000	.000		.	.

10. Exponential Model

$$Y = b_0 e^{bit} + \varepsilon$$

Figure 2.12 EXPONENTIAL MODELS FOR SOFTWARE EXPORT

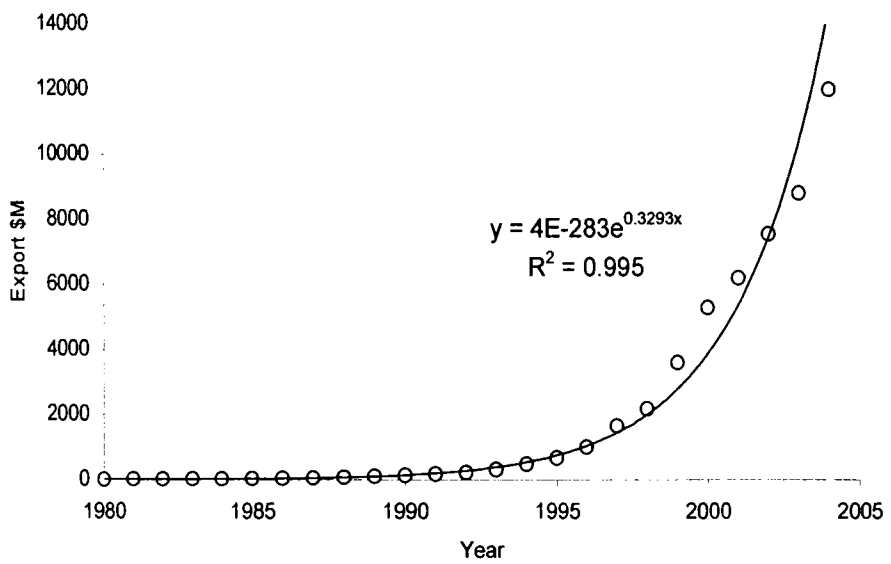


Table 2 .25 SUMMARY OF EXPONENTIAL MODEL

R	R Square	Adjusted R Square	Std. Error of the Estimate
.998	.995	.995	.175

Table 2 .26 REGRESSION COEFFICIENTS OF EXPONENTIAL MODEL

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Year	.329	.005	.998	67.766	.000
Constant	3.76E-283	.000		.	.

Table 2 .27 SUMMARY OF DIFFERENT ECONOMETRIC MODELS

Equation		Parameter Estimates			
	R^2	Constant b0	b1	b2	b3
Linear	.631	-711651.210	358.271		
Logarithmic	.630	-5413537.470	712865.853		
Inverse	.628	714081.264	-1418398496.486		
Quadratic	.632	-355218.664	.000	.090	
Cubic	.634	-236408.067	.000	.000	.000032
Compound	.995	3.76E-283	1.390		
Power	.995	.000	655.923		
S	.995	661.539	-1306560.094		
Growth	.995	-650.307	.329		
Exponential	.995	3.76E-283	.329		
Logistic	.995	2.660E+282	.719		

Six unique models viz; Compound model, Power, S model, Growth, Logistics and Exponential model can all been fitted to the software export figures. This is because these are having equal values of model adequacy. Among all the models employed here, the researcher chooses the exponential model since it is accepted by the discipline and the uniqueness of interpretation.

Exponential model shall be represented as

$$\text{Export} = 3.76 \text{ X } 10^{-283}\, e^{0.329 \text{ X year}}$$

This indicates the fact that 32.9 percent compound rate of growth is witnessed. This model takes into consideration 99.5 percent of all the variations in the software export domain.

For the purpose of comparison, the domestic revenue figures from 1993-94 to 2004 have availed of and taken. Since this being the case, export figures during the same period have also been considered for modeling purposes.

Figure 2.13 EXPONENTIAL MODEL FOR THE DOMESTIC REVENUE OF SOFTWARE

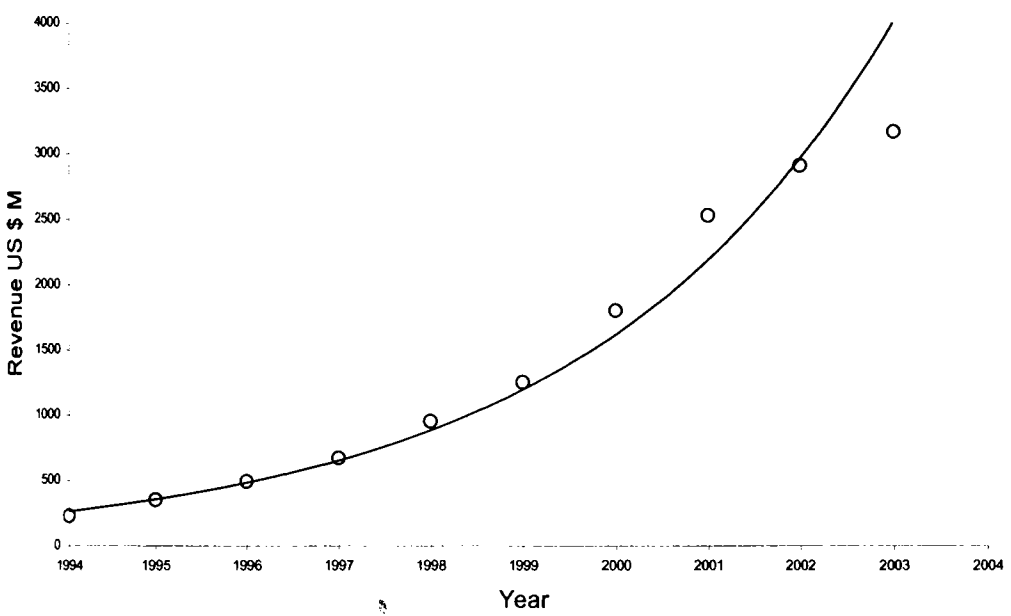


Table 2 .28 SUMMARY OF EXPONENTIAL MODEL FOR DOMESTIC REVENUE

R	R Square	Adjusted R Square	Std. Error of the Estimate
.991	.983	.981	.134

Table 2 .29 REGRESSION COEFFICIENTS OF DOMESTIC REVENUE ON EXPONENTIAL MODEL

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Year	0.291	.013	.991	22.732	.000
Constant	2.07E-250	.000			

The Compound Annual Growth Rate (CAGR) in export is 32.9 percent while in case of domestic sale; the CAGR is only 29.1 percent. This shows a difference of 3.8 percent in CAGR. The difference actually aggravates the situation. The gap on exponential growth pattern will be getting widened over the years to ensue. High values of R square for the above two models reflect a high degree of model adequacy.

The need for leveraging the domestic market in this scenario is high and demanding.

2.6 SIGNIFICANCE OF LEVERAGING THE DOMESTIC MARKET

India, in one sense, is at great disadvantage in the form of 'soft demand from local customers' (Einhorn, 2002). India's surge in software exports, which is separated from an Information and Communications Technology (ICT) base, means that the industry must innovate the value chain.

This being the case, the Indian industry may face increasing competition due to the erosion of its labour cost advantage. (D' Costa, 2004). Maximum erosion of low wage advantage is in the higher-order skill-levels. A manifestation of this is evident from the fact that many Indian IT firms have set up development centers in China, for example, Satyam Computer Services. Rising wage costs may dampen the industry's propensity to serve the domestic market. With global demand surpassing the labor supply, there is a case of India may be facing the scarcity of strategic IT skills.

Leveraging the domestic market is necessary in another sense. In the absence of a booming domestic IT market, Indian skills may continue to be hijacked by the pomp and splendor of international firms and markets. The US had relied on H1B visas to secure large armies of Indian IT workers: almost half of the total number of visas in 1999, while China obtained less than 5 percent (OECD, 2002). Even Indian firms who have business operations in the US like TCS, Wipro etc resorted to the H1B visa system to recruit Indians.

Here comes the criticality of the low profile stature of India's domestic IT system. Herculean task has to be executed to retain the highly skilled IT professionals in India. To make sure that these skilled experts will 'circulate' back to India, as is currently being observed (Kripalani, 2002), the Indian domestic economy has to be elevated to higher levels and physical quality of life index (PQLI) vastly improved.

Efforts by Indian firms such as Encore software and the Indian Institute of Science (IISc) had led to the development of an indigenous and inexpensive computer called Simputer. Another striking innovation has been in the filed of Indian languages. HCL Info systems has launched Unicode compatible PCs to support seven Indian languages. These are examples of serving the national market, which is not at the expense of the export market. What is needed is a more institutionally driven, large-scale, concerted thrust towards raising the technical and commercial profile of the Indian software industry, which would in the end meet India's developmental needs.

2.7 CAUSE – ACTION THESIS

It has found space in many a literature that a great deal of software being developed in India by Indian firms are written for their cause and are used by themselves, but is not captured by various domestic market figures (Arora and Arunachalam , 2000). But it is found that such application software does not form a substantial portion as such. Since most of the firms operating in the domestic sector sell software products and packages rather than software services, in-house software written by software users does not attract much attention. At the same time, large fraction of the domestic software industry consist of resale of software packages developed by foreign, principally US firms, thus overstating the extent of software written for the domestic market. In essence, a factor of neutralization comes into play.

A large chunk of software packages developed by Indian firms, which aimed at the domestic market have not been very successful (D'Costa, 1998). This is mainly on account of stiff competition Indian companies had to face from multinational brands. Much intellectual energy and propensity has to be put by Indian firms operating in this area in their research and development. Not only that, large scale industrialization and modernization pursuits undertaken by the government is mandatory.

Efforts on the development of domestic software were not very remunerative compared to the export market. Structural alterations in the economy for boosting efficiency and profitability of different economic sectors shall have the desired result. Lack of experience, especially in design and marketing which is necessary for augmenting a successful product has added to the Indian player's failure. A better package of remuneration by Indian firms and a good economic climate can attract experienced managers in design and marketing, who are successful executives of 'Silicon Valley'.

Most of the interviews suggest that a mechanism of weak intellectual property rights is a culprit for the lackluster performance of Indian firms in developing software market. The hesitation on the part of Indian users to pay large sums for software products has undoubtedly been very important. As a result, most of the reputed firms have turned in providing services for the export market (Udell,1993, Gupta, 2000).

The use and purchase of personal computers are gathering momentum in India but the interviews suggest that the communication band

width is still limited. One major problem found out by the study lies where the attitude of the telecommunication authorities is stated to be intransigent and discouraging since they tried to hold a monopoly over communication in India. Of course, the privatization drive by the state hastened the process of decontrolling and a better band width is expected to be in place. But the net result is that internet access in India is still slow and expensive.

The adoption of IT for business and government applications is also hampered by numerous infrastructure constraints, for instance, a substandard system of transmission and scarcity of electricity and a poor transportation system. Under developed nature of the economy, limited competition and inexperienced top managers also played their distractive roles.

Many firms that began with a domestic market focus seem to have moved away towards less challenging but more lucrative overseas tasks. But these firms predominantly provide low-end software services to foreign companies. This does not mean that they are not capable of providing high-end services like requirement analysis, specification, high level design, larger scale system integration etc. Rather, they are forced to render low-end services such as porting, maintenance and application development and enhancement. Foreign firms especially the US corporates, reserve their limited IT professionals for high end services, there by, limiting their expenditure burden. To reverse this trend there should be an automatic demand for high end designs within the country so that software talent will be in high demand, and domestic market poised to higher growth. The role

of venture capitalists had to be strengthened by proper government policies, protection laws and insurance mechanisms. Proper legal measures are necessary to tackle piracy ills. A constructive mechanism of intellectual property rights has to be in place. Ills of overt bureaucratization must be cured with vigorous liberalization measures.

The Indian state should vigorously pursue its role of expanding and modernizing transport and telecommunication especially the level of connectivity and better band width, the state-of-the-art technologies.

There are concerns in India regarding the outflow of highly trained and educated technical labor force whose higher education has been subsidized to a great extent by the Indian public at large. For the Indian economy to get its due benefits from this subsidization it is high time that this work force has to be extensively used for the standardization of India's domestic software sector and advancement of Indian economy.

Good governance is the buzz word of post-industrial and post-capitalist societies all over the world. India is suffering in great proportions from poor governance, misgovernance or no governance. To get good governance truly happened, India has to be more modern by adopting the world class software applications into our system. Better standard of living and a competitive economy can attract foreign entrepreneurs to start their ventures in India. Indian professionals working in the US software industry can turn out to be 'intrapreneurs' in this country. It is a fact that export led growth could be sustained only if there is a strong domestic software market. Domestic and export projects are two different ball games.

Chapter

3

SOFTWARE SUCCESS: A COMPARATIVE STUDY OF INDIA, ISRAEL AND IRELAND

SOFTWARE SUCCESS: A COMPARATIVE STUDY OF INDIA, ISRAEL AND IRELAND

3.1 INTRODUCTION

India, Israel and Ireland – All these three countries are studied in combination by scholars these days because they have many features in common in the area of software industry and exports. All of them have been accepted as major software players by the world nations. These three countries are catching up with the developed world in software technology, its sophistication and industry. Many analysts feel that India, Israel and Ireland should be included in one specific group. Some feel that these three players shall be included in the 'First Tier' category of a 4 – Tier taxonomy (Carmel, 2003). Some have even dared to categorize them as '3Is' and 'First Tier' nations (Heeks and Nicholson, 2002).

All the three nations are being cited as mature software exporting countries. Though they are latecomers into software industry, they are widely being recognized as mature software exporters.

All the three are cited as the success cases of 1990s. The national orientation for global software markets in these nations were born and matured around the same age. Some experts developed a model called 'Software Export Success Model' by incorporating the success factors of India, Ireland and Israel. (Heeks and Nicholson, 2002). Certain common

underlying factors behind the success story of the above said three nations shall be noted here. They are

1. Demand for software
2. National software vision and strategy;
3. International linkages and trust
4. National software industry characteristics; and
5. National software-related infrastructure.

This chapter especially deals with two kinds of econometric investigations by taking the export data of these 3 nations. The first kind of econometric investigation aims at constructing a feasible economic model. The second kind of investigation tries at applying the econometric tool of 'Panel Regression'.

3.2 REGRESSION MODELING

In this section, it is aimed to find out and check the individual specifications of different countries like their Compound Annual Growth Rate (CAGR) etc.

Regression analysis is concerned with the study of the dependence of one variable, 'dependent variable' on one or more other variables, ' the explanatory variables', with a view to estimating and / or predicting the (population) mean or average value of the former in terms of the known or fixed (in repeated sampling) values of the latter.

In regression, the researcher tried to estimate or predict the average value of one variable on the basis of the fixed values of other variables In regression analysis, there is an asymmetry in the way the dependent and explanatory variables are treated. The dependent variable is assumed to be statistical, random, or stochastic, ie, to have a probability distribution. The explanatory variables, on the other hand, are assumed to have fixed values. A detailed discussion on econometric modeling, especially regression analysis, shall be found in the book 'Econometric Models, Techniques and Applications' (Intriligator, 1978).

The table 3.1 shows the export data of India, Israel and Ireland from 1991 to 2004

Table 3.1: EXPORT FIGURES OF INDIA, ISRAEL AND IRELAND

Year	India ($m)	Israel ($m)	Ireland (€ m)
1991	174	110	2044
1992	220	135	2248
1993	314	175	2339
1994	481	220	3145
1995	668	300	3570
1996	997	600	4215
1997	1650	1000	5436
1998	2180	1500	5860
1999	3600	2000	6520
2000	5300	2600	8500
2001	6200	2650	12257
2002	7550	2550	12997
2003	8800	2680	14363
2004	11984	2840	15978

Sources : **a). India – Dataquest**

b). Ireland - National software Directorate, Ireland http://www.nsd.ie/htm/ssii/stat.htm

c) Israel – Israeli Association of Software Houses, Israel. http://www.iash.org.il/content/SoftwareInds/StatisticalInformation.asp

3.3 INDIA – MODELING THE EXPORT DATA

An exponential model is suggested which has the following form.

$$Y = ae^{bx}$$

where,

Y = export a, b = parameters x = year

The Figure 3.1 illustrates the modeling of India's software exports

The estimates for the parameters are obtained by the method of least squares.

Figure 3.1 : EXPONENTIAL MODEL FOR SOFTWARE EXPORT OF INDIA

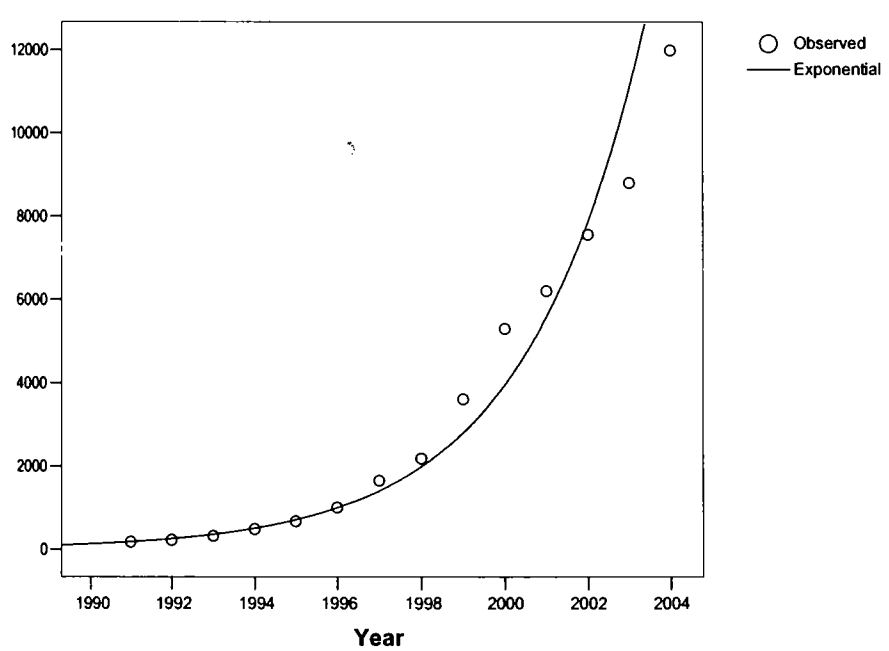


Table 3.2: MODEL SUMMARY - INDIA

R	R Square	Adjusted R Square	Std. Error of the Estimate
.993	.987	.986	.173

Table 3.3 ANOVA TABLE : INDIA

	Sum of Squares	df	Mean Square	F	Sig.
Regression	26.955	1	26.955	896.960	.000
Residual	.361	12	.030		
Total	27.315	13			

Table 3.4: REGRESSION COEFFICIENTS: INDIA

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
Year	.344	.011	.993	29.949	.000
(Constant)	4.14E-296	.000			

The estimated values for the parameters are:

a = 4.14E-296

b = 0.344

The goodness of fit of the suggested model is measured by the R square value. Here R square value is 0.987. The high value of R Square indicates the suitability and adaptability of suggested model.

The parameter b is known as the regression coefficient, which measures the marginal change in export. The suggested model is 'multiplicative' in nature and we can term the parameter 'b' as the Compound Annual Growth Rate (CAGR).

3.4 ISRAEL – MODELING THE EXPORT DATA

Exponential model is best suited with regard to Israel's historical export data.

Figure 3.2 EXPONENTIAL MODEL FOR SOFTWARE EXPORT OF ISRAEL

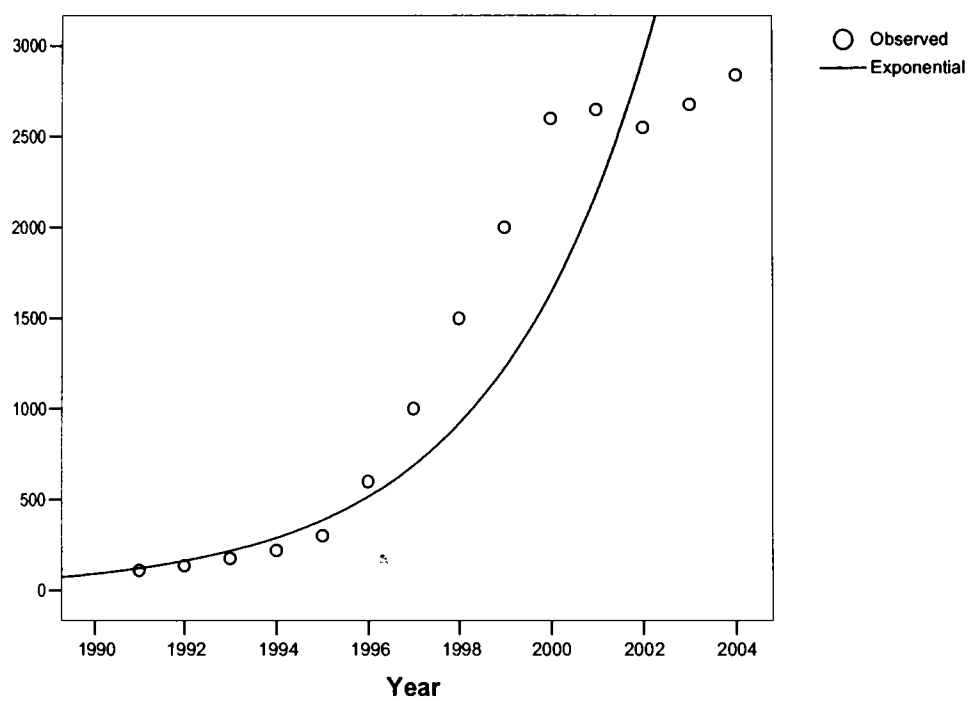


Table 3.5 MODEL SUMMARY-ISRAEL

R	R Square	Adjusted R Square	Std. Error of the Estimate
.959	.920	.914	.370

Table 3.6 ANOVA TABLE- ISRAEL

	Sum of Squares	df	Mean Square	F	Sig.
Regression	18.997	1	18.997	138.562	.000
Residual	1.645	12	.137		
Total	20.643	13			

Table 3 .7 REGRESSION COEFFICIENTS – ISRAEL

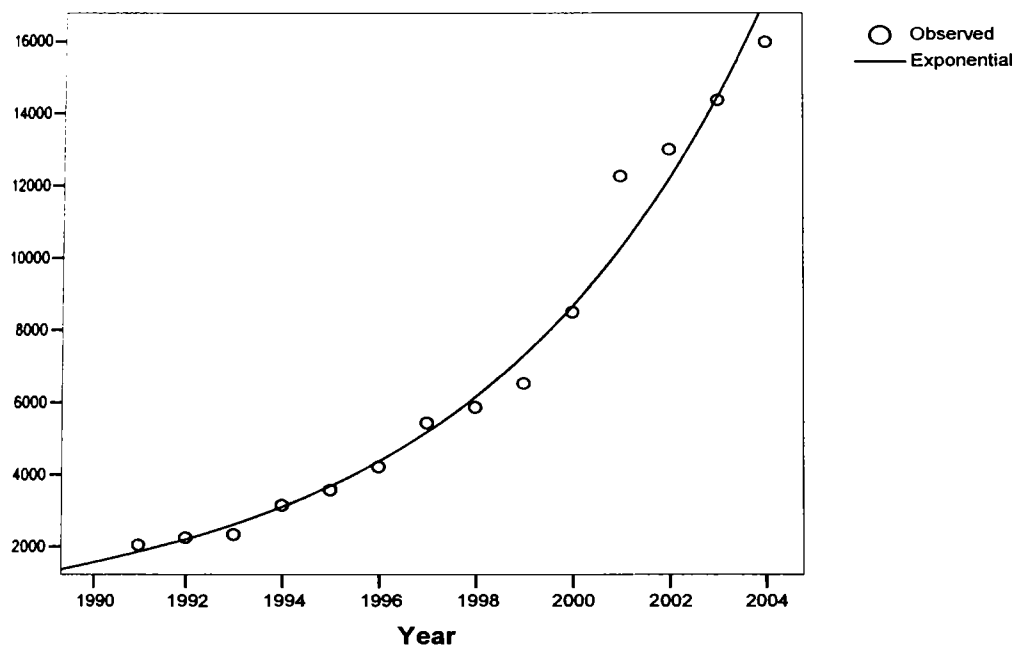
	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Year	.289	.025	.959	11.771	.000
(Constant)	1.65E-248	.000			

The R square value is 0.920 which means the suggested model is accurate upto 92 percent.

From the Figure 3.2, it is understood that some major aberration could be observed in the exponential growth pattern. The year 2001, 2002 and 2003 have witnessed either no growth or negative growth.

3.5 IRELAND –MODELING THE EXPORT DATA

Figure 3.3: EXPONENTIAL MODEL FOR SOFTWARE EXPORT OF IRELAND



Similar kind of modeling shall be applied in case of Ireland also.

Table 3.8 MODEL SUMMARY: IRELAND

R	R Square	Adjusted R Square	Std. Error of the Estimate
.994	.988	.987	.083

Table 3.9 ANOVA TABLE : IRELAND

	Sum of Squares	df	Mean Square	F	Sig.
Regression	6.653	1	6.653	968.548	.000
Residual	.082	12	.007		
Total	6.736	13			

Table 3.10 REGRESSION COEFFICIENTS : IRELAND

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Year	.171	.005	.994	31.122	.000
(Constant)	2.49E-145	.000		.	.

Under the exponential model, the R square value for Irish exports estimated at 0.988. The CAGR for Ireland is 0.171.

3.6 EXPORT – EXPONENTIAL MODEL: INFLUENCE

It is widely recognized that all the three nations are leading players in software technology and its international marketing. The above analysis conveys a clear inference that even though Ireland is the leader among the three, India could aptly be called 'the leader-prospect'. The CAGR, when compared, it is the CAGR of India is the maximum and it is nearly double the value of Ireland.

Table 3.11: EXPONENTIAL MODEL SUMMARY FOR THE COMBINATION

Country	R square	CAGR
India	0.987	34.4%
Israel	0.920	28.9%
Ireland	0.988	17.1%

Many felt that India, Israel and Ireland were successful because all benefited from a strong national emphasis on advanced technical education that dates back at least one or two generations (Carmel, 2003). Strong human capital in software cannot emerge within a few years.

Although they are leaders in software technology, their specialization and domain of expertise are different. For example, Ireland has specialized in the services projects, and into niche product markets, while Israel specialized in software products, especially in data commutations and information security. On the other hand, India has specialized in customized service software exporting. India is referred to be, even, the world's call centre.

Many believe that these countries have many attributes in common. One example is the standing of these countries in the map of world production of Information and Communication Technology (ICT) goods. India's position in the global ICT market is low, suggesting a disconnection between software development and a domestic hardware base. Data on global production of ICT goods reflect several characteristics and relative standings of India, Ireland and Israel.

Table 3.12: WORLD PRODUCTION OF ICT GOODS (SELECTED COUNTRIES INCLUDING INDIA, IRELAND , ISRAEL AND OECD

Country	1999 Total ICT $m	Share of world total (%)	1990-99 CAGR %	1995-99 CAGR %	1997-99 CAGR %
US	320840	29.5	5.8	4.4	20.3
Japan	220728	20.3	2.3	4.0	1.3
Korea	57597	5.3	10.8	4.2	19.2
Germany	47545	4.4	0.5	4.4	37.9
Ireland	16481	1.5	12.8	17	54.9
UK	47734	4.4	6.2	6.9	28.4
OECD 21	843121	77.5	4.2	1.4	16.5
China	59738	5.5	19.8	20.1	NA
Malaysia	38956	3.5	20.1	9.0	32.8
Singapore	40755	3.7	11.9	0.7	-4.7
Taiwan	40979	3.8	12.7	9.0	30.6
India	4841	0.4	0.4	-0.3	5.5
Brazil	13484	1.2	1.3	-5.0	-30.4
Israel	6311	0.6	14.6	11.2	35.5
Total	1088539	100.00	5.6	1.4	22.3

***Source*: Adapted from OECD 2002,2000**

The OECD clearly dominates global production of ICT goods, with 77.5 percent of the world total. The US and Japan together have 50 percent of the global output and they dominate the production of various ICT goods.

Indian software producers in the early 1990s were confident that by the end of the decade India's hardware industry would be comparable to

Taiwan's (Lakha, 1999). In 1999, Taiwan's ICT goods production was ten times that of India's. But the noticeable feature is that countries like Ireland and Israel had greater production in these segments than India.

The standings of the three nations on the growth front shall be examined. On the growth front, the ICT industry exhibits some consistent trends. During 1990-99, the decade of technology led innovation and resultant expansion of the world economy, countries like Ireland and Israel have grown quite rapidly: 12.8 percent and 14.6 percent annually, respectively. But if we take the percentage of 1997-99, almost 55 percent change occurred in Ireland's case, while it has been 35.5 percent change in case Israel. India's Compound Annual Growth Rate (CGGR) percent change has been much dismal and it was only 5.5.

3.7 PANEL AUTO-REGRESSION ANALYSIS

Panel data analysis is an increasingly popular form of longitudinal data analysis among social sciences especially Economics. A panel is a cross-section or group of people who are surveyed periodically over a given time span.

Panel data analysis is a method of studying a particular subject within multiple sites, periodically observed over a defined time frame. In Economics, panel data analysis is used to study the behaviour of firms and wages of people over time. With repeated observations of enough cross-sections, panel analysis permits the researcher to study the dynamics of change with short time series. The combinations of time series with cross-

sections can enhance the quality and quantity of data in ways that would be impossible using only one of these two dimensions (Gujarati, 1995).

Panel data analysis endows regression analysis with both a spatial and temporal dimension. The spatial dimension is regarding to a set of cross-sectional units of observation. These could be countries, states, firms, commodities, groups of people etc .The temporal dimension pertains to periodic observations of a set of variables characterizing these cross-sectional units over a particular time span.

The econometric formulation for this study assumes the following model

$$Y_{it} = \alpha + \beta' Y_{it-p} + u_i + e_{it}$$

Where i represents the countries (in this case 3) and t represents the time period (1991-2004). α is a scalar parameter and β is a parameter vector , both of which are to be estimated. e_{it} is an error term that is assumed to have mean zero and constant variance. For a given country u_i is constant over time but assumed to vary by cross section. Here lagged values of export are used as the explanatory variables in the above model.

Dependent upon one's distribution assumption associated with u_i ,the resulting econometric model will either be a fixed effects or a random effects model. If u_i is assumed to be a fixed parameter, then in addition to α and β , the model estimates each effect u_i . The estimator for this model is also referred to as the 'within' estimator since it is equivalent to estimating

$$(Y_{it} - \bar{Y}_i) = \beta'(Y_{it-p} - \bar{Y}_i) + (e_{it} - \bar{e}_i)$$

i =1,2,3

t ==1991,.....2004

Alternatively if u_i is assumed to randomly vary (eg, cross section units are a sample from a large sets of cross section units) , then the model's error term becomes u_i+e_{it} which is assumed to satisfy the standard assumptions of zero mean and constant variance and zero correlation with explanatory variables.

The number of lags p is determined based on the auto correlation function and partial auto correlation function.

The computational details are given below.

Table 3.13 AUTOCORRELATIONS: INDIA

Lag	Autocorrelation	Std.Error(a)	Box-Ljung Statistic		
			Value	df	Sig.(b)
1	.807	.241	11.220	1	.001
2	.606	.231	18.075	2	.000
3	.399	.222	21.324	3	.000
4	.199	.211	22.215	4	.000
5	.000	.200	22.215	5	.000
6	-.172	.189	23.047	6	.001

Table 3.14 PARTIAL AUTOCORRELATIONS INDIA

Lag	Partial Autocorrelation	Std.Error
1	.807	.267
2	-.129	.267
3	-.141	.267
4	-.128	.267
5	-.166	.267
6	-.115	.267

Figure 3.4 PARTIAL ACF : INDIA

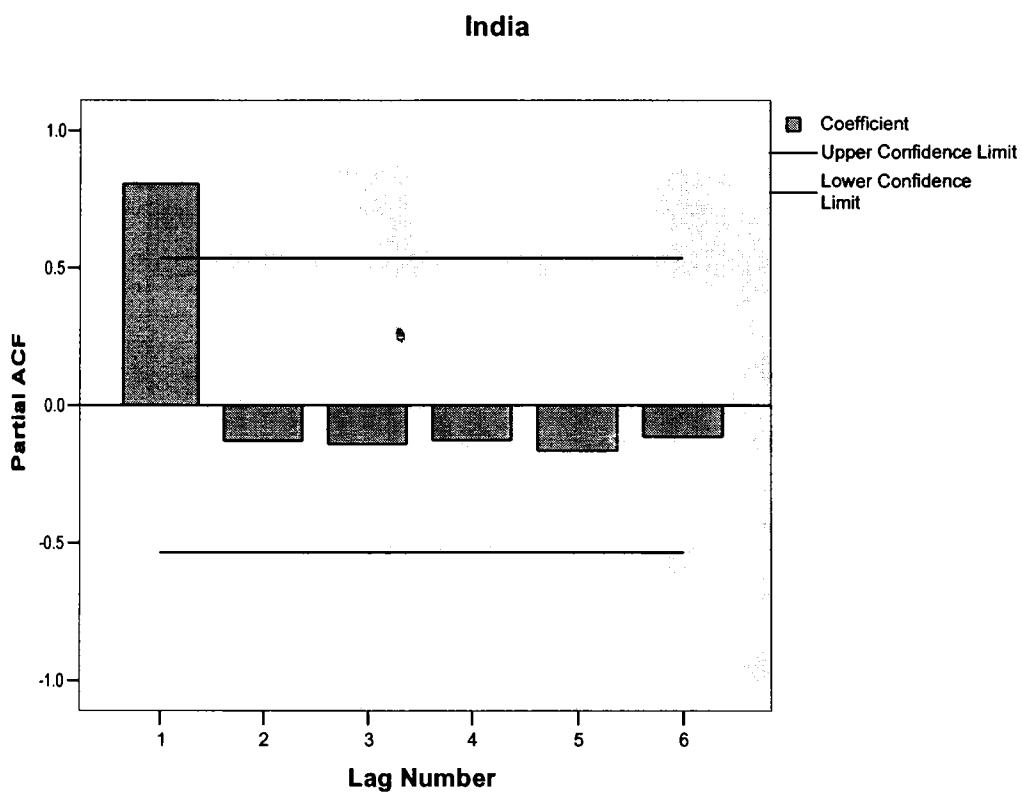


Table 3.15 AUTOCORRELATIONS - ISRAEL

Lag	Autocorrelation	Std.Error(a)	Box-Ljung Statistic		
			Value	df	Sig.(b)
1	.834	.241	11.981	1	.001
2	.635	.231	19.506	2	.000
3	.417	.222	23.043	3	.000
4	.178	.211	23.753	4	.000
5	-.062	.200	23.849	5	.000
6	-.238	.189	25.435	6	.000

Table 3.16 PARTIAL AUTOCORRELATIONS ISRAEL

Lag	Partial Autocorrelation	Std.Error
1	.834	.267
2	-.198	.267
3	-.179	.267
4	-.219	.267
5	-.201	.267
6	-.012	.267

Figure 3.5 PARTIAL ACF : ISRAEL

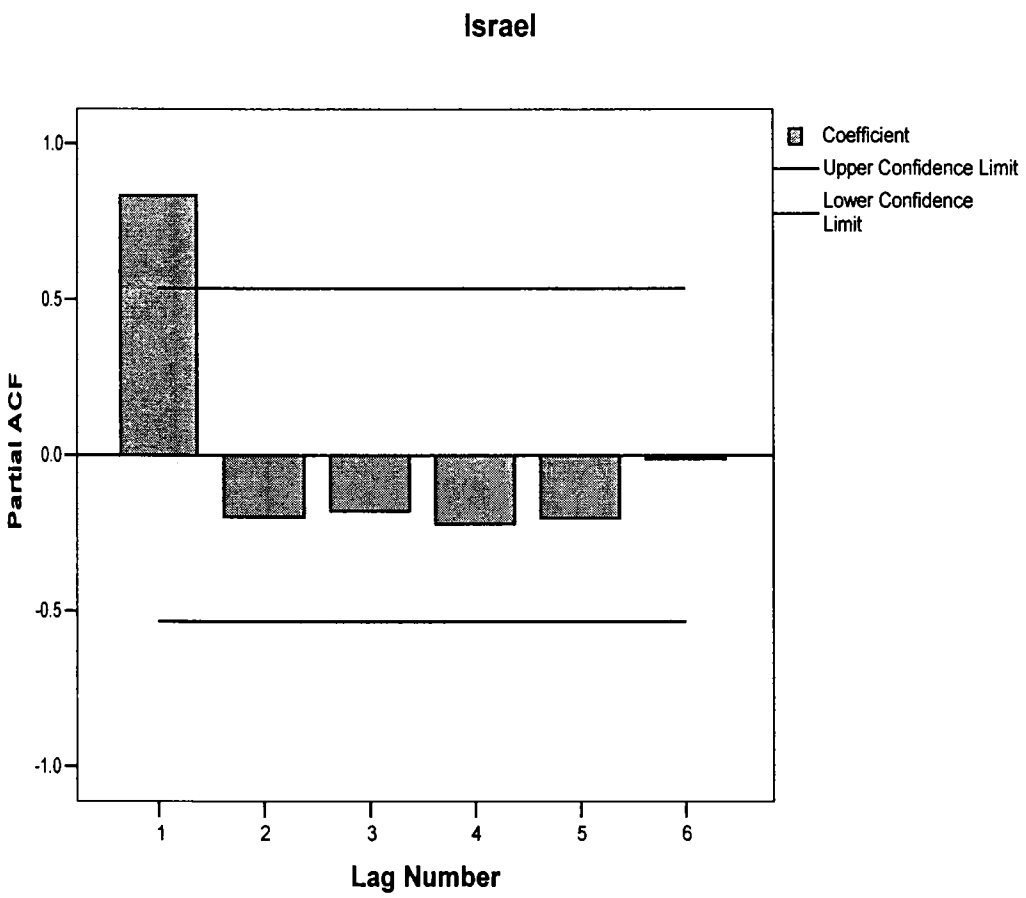


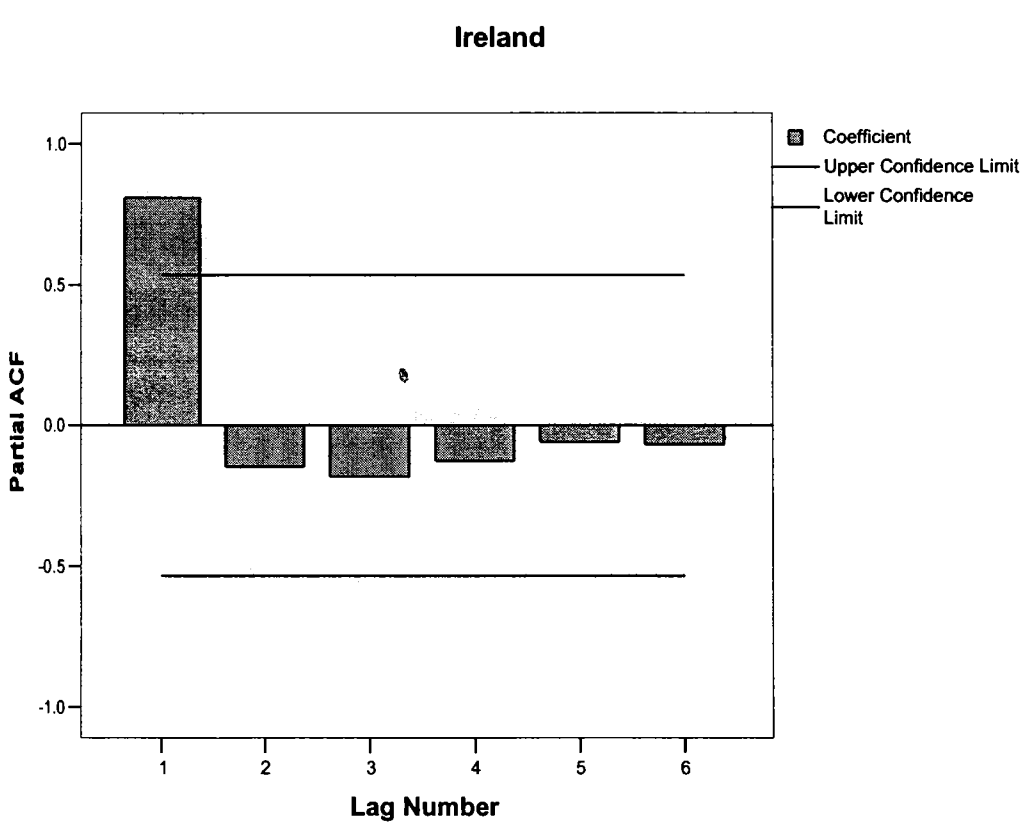
Table 3.17 AUTOCORRELATIONS IRELAND

Lag	Autocorrelation	Std.Error(a)	Box-Ljung Statistic		
			Value	df	Sig.(b)
1	.809	.241	11.289	1	.001
2	.604	.231	18.101	2	.000
3	.380	.222	21.041	3	.000
4	.167	.211	21.662	4	.000
5	-.007	.200	21.664	5	.001
6	-.142	.189	22.230	6	.001

Table 3.18 PARTIAL AUTOCORRELATIONS IRELAND

Lag	Partial Autocorrelation	Std.Error
1	.809	.267
2	-.148	.267
3	-.183	.267
4	-.127	.267
5	-.058	.267
6	-.067	.267

Figure 3.6 PARTIAL ACF: IRELAND



The correlograms suggest that first order lag need only to be considered in the analysis and modeling on panel auto regression lines. Thus, the model becomes

$$Y_{it} = \alpha + \beta' Y_{it-1} + u_i + e_{it}$$

Table 3.19 FIXED EFFECT MODEL FOR SOFTWARE EXPORT OF INDIA, ISRAEL AND IRELAND

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(E?(-1))	0.963219	0.018783	51.28181	0.0000
Fixed Effects				
India	0.592901			
Israel	0.492184			
Ireland	0.472919			
Weighted Statistics				
R-squared	0.997812	Mean dependent var		8.647937
Adjusted R-squared	0.997625	S.D. dependent var		2.882530
S.E. of regression	0.140480	Sum squared resid		0.690708
Log likelihood	25.91169	Durbin-Watson stat		1.470800
Unweighted Statistics				
R-squared	0.989532	Mean dependent var		7.713959
Adjusted R-squared	0.988635	S.D. dependent var		1.329624
S.E. of regression	0.141746	Sum squared resid		0.703216
Durbin-Watson stat	1.78019			

Table 3.20 RANDOM EFFECT MODEL FOR SOFTWARE EXPORT OF INDIA, ISRAEL AND IRELAND

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.608626	0.151186	4.025679	0.0003
LOG(E?(-1))	0.951265	0.019139	49.70311	0.0000
Random Effects				
India	0.056542			
Israel	-0.029997			
Ireland	-0.026546			
GLS Transformed Regression				
R-squared	0.989315	Mean dependent var		7.713959
Adjusted R-squared	0.989026	S.D. dependent var		1.329624
S.E. of regression	0.139287	Sum squared resid		0.717828
Durbin-Watson stat	1.725342			
Unweighted Statistics including Random Effects				
R-squared	0.989555	Mean dependent var		7.713959
Adjusted R-squared	0.989273	S.D. dependent var		1.329624
S.E. of regression	0.137712	Sum squared resid		0.701685
Durbin-Watson stat	1.651232			

By taking into account the software export figures of India , Israel and Ireland , two models have been developed – both a fixed effects model and random effects model.

The fixed effects model for India shall be constructed as

$$Y_t = 0.963219 Y_{t-1} + 0.5929 + e_1$$

The fixed effects model for Israel is

$$Y_t = 0.963219Y_{t-1} + 0.4921 + e_2$$

And the afore said model for Ireland is constructed as

$$Y_t = 0.963219Y_{t-1} + 0.4729 + e_3$$

The R square value is 0.9978 which is significantly high. The Durbin Watson Statistics is 1.78 which implies the absence of serial correlation in the error terms.

The above model suggests that the export of the next fiscal depends upto 96.32 percent of the export of the current fiscal for all the three nations. Even in this case, the fixed effect coefficient is different for all the three countries which actually represents the prospective variation in the future exports of the three nations. However, the fixed effect coefficient is more favorable in the case of India. The innate software exporting capability estimated that India (when building this model) will contribute more for its future export growth, when compared with both Israel and Ireland.

The alternative model is the random effects model.

The random effects model for India shall be built as

$$Y_t = 0.608626 + 0.951265Y_t - 1 + 0.0542 + e_1$$

In the same way, the random effect model for Israel is

$$Y_t = 0.608626 + 0.951265Y_{t-1} - 0.0299 + e_2$$

The same model for Ireland is constructed as

$$Y_t = 0.608626 + 0.951265Y_{t-1} - .0265 + e_3$$

In this case, the model adequacy is 98.93 percent. The Durbin-Watson Statistics indicates the absence of serial correlation.

The above models interpret that the export of the next fiscal depends up to 95.12 percent of the export of the current fiscal, for all the three nations. The random effects co-efficient for India is a positive one ie, 0.056 while Israel and Ireland capabilities are negative. The prospective capability in mature software exporting of India is a unique one since this country alone has a positive random coefficient among the 3I's.

Chapter

4

FACTOR IMPACT AND FIRM SIZE: AN ANALYSIS

FACTOR IMPACT AND FIRM SIZE: AN ANALYSIS

4.1 INTRODUCTION

After having a long run interaction with software firms of all sizes and seeing the scarcity of authenticated materials, the researcher has grasped that an explorative study is to be carried out by taking into consideration the industrial milieu and view points of the firms of different sizes. Size and turn over matter when considering the impact the firms can generate both in innovation as well as revenue fronts. In this scenario, the investigator attempts to figure out the comparative standings of different sized firms through a primary survey which encompasses the responses of competent personnel from IT industry.

4.2 SAMPLING DESIGN

The population for the survey is a large aggregate of software professionals, entrepreneurs, managerial personnel and academia. Surveying the whole of population is found to be impractical and almost impossible primarily because of the geographical spread of the firms and high degree of inaccessibility of the professionals. Therefore, the researcher decided to go for sampling method.

In order to fix the sampling size, a pilot study has been carried out at Bangalore. The researcher contacted 37 IT professionals comprising the project leaders, system analysts, managers and the programmers. The

sample group was served with a questionnaire in which 40 questions were enumerated. The information collected was analyzed for content validity and reliability and necessary modifications were made in the questionnaire. The final questionnaire is given in the *appendix.*

The crucial inference which was arrived at was that the governing factors behind the software success story of different firms were almost similar, irrespective of their geographic differentials. Owing to the fact that the underlying factors are found to be highly complex and overlapping, the researcher felt for the application of sophisticated statistical tools for the analysis and interpretation. Such routines demand a fairly big sample size. Therefore, it is felt that a minimum sample size of 1000 is necessary for the scope of the study. Given the nature of the IT industry and its correlation with the Information and Communication Technology (ICT) industry, it was found out that it would be advisable to go for an on-line survey for a part of the sample.

Around a quarter of the respondents were approached directly in six major software development hubs viz; Bangalore, Chennai, Noida, Pune, Hyderabad and Kerala The direct method was opted (for partial sample) on account of its high reliability. It also gives the opportunity for the investigator to have direct interaction with the respondents, thereby facilitating discussions on related topics on a comprehensive style. It shall be noted here that due weightage was given for the response through direct approach, at the analysis stage. The details of the sampling design as a

result of the direct approach are enumerated through the table 4.1 given below:

Table 4.1 SAMPLE SIZE: DIRECT APPROACH METHOD

Category	No
Programmers	117
Marketing Executives	53
System Analysts	71
Network Administrator	23
Software Developers	19
Total	283

The details of the total sampling design , including those responses which received by means of online survey are given in the table 4.2 below.

Table 4.2 SAMPLE SIZE: ON-LINE AND DIRECT APPROACH

Category	No
On-line Survey	806
Face-to-face Interview	283 *
Total	1089

*312 respondents were contacted directly. However 29 responses were either partial or inconsistent. So, they are not included for analysis. 283 responses were those which excluded the defective and partial ones.

Based on the turnover of companies during 2003-04, the software development firms were classified into 3 categories.

a) Big IT firms (annual turnover above Rs. 2500 crores)

b) Medium IT firms (annual turnover ranges between Rs. 500 crores to Rs. 2500 crores)

c) Small IT firms (Turnover of below Rs. 500 crores)

The researcher had visited 132 offices of 57 software firms, which scattered over six different locations. The table 4.3 depicts a classification of software firms visited by the researcher at different locations.

Table 4.3 GEOGRAPHICAL OF SPREAD OF SAMPLE SIZE

Category (City)	Big firms	Medium firms	Small firms	Total
Bangalore	2	5	7	14
Chennai	1	2	4	7
Hyderabad	1	2	3	6
Pune	0	3	6	9
Noida	0	4	10	14
Kerala	0	0	7	7

Out of the 283 respondents (those who responded consistently), 56 respondents were those who have been working in large size companies. 73 were from 'medium' category companies and 154 were from 'small' software business firms.

The classification given in table 4.4 is derived out of the number of investigated companies and the number of respondents.

Table 4.4 CLASSIFICATION OF RESPONDENTS BASED ON DESIGNATION

Size	Programmers	Marketing Executives	System Analyst	Network Administrator	Software Developers	Total
Big	20	14	10	8	4	56
Medium	43	12	9	5	4	73
Small	54	27	52	10	11	154
Total	117	53	71	23	19	283

4.3 SAMPLING PROCEDURE

It is to be noticed that no specific standard sampling procedures could be properly applied while collecting the samples. This is because of three important reasons.

a) Software professionals could not easily be accessed mainly because of their busy schedule

b) A large number of professionals categorically demanded to obtain prior permission from the concerned company's corporate office.

c) Although many executives were willing for interviews, they were reluctant to fill-in the questionnaire

Therefore, the adopted method of sampling chosen by the investigator has been 'convenience sampling'. Even though this being the

case, proper precautionary measures were taken to keep due representation for all the different segments of population, in fact.

In addition to the direct personal method undertaken with respect to 283 respondents, an additional on-line survey was conducted. This was preferred by keeping in mind the following:

a) The on-line trackers, since they are not in the settings of their mother-concern, are ready to share their view points, without keeping any reservations. Thus, the data obtained through this method will be more reliable and accurate.

b) Those who track the posted questionnaire are those who are really interested as well as knowledgeable/ experienced. This is because only those who have deep insight on the discussed topic are generally getting into such discussion forums.

c) The direct personal method which has been chosen was basically an 'India-specific' one, geographically. But the scope of the research topic extends beyond geographical limitations. In the on-line survey method, 'overseas' software professionals have also been able to participate in. The on-line survey record kept by the researcher shows that there were participants from Coral Networks in Boston, USA, Sun Microsystems and even scholars from MIT's Computer Sciences Lab.

d) An innate advantage of on-line survey is that the responses received will always be completed ones.

In total, 806 responses were collected. Among these, 232 respondents (28.78 percent) were those from other countries.

A questionnaire was developed to measure 49 independent variables or Software Success Phenomenon Constructs (SSP constructs) which were grouped under eleven specific categories. The questionnaire seeks the perceptions of experienced software developers on a five-point Likert Scale. The 49 variables were identified based on an extensive survey of literature on Software Success Phenomenon (SSP).

4.4 ANALYSIS OF INDIVIDUAL FACTOR IMPACTS

In this section, the researcher initiates to analyze and evaluate the data which were collected through direct personal interviews. It is decided to go for analysis and evaluations of the key queries under eleven different heads. One of the major aims of this initiative is to check whether the opinions about these queries are significantly different with respect to the size of the firm. This is on account of the fact that the size of a firm is a critical determinant influencing its total turnover. The size also matters as regards the country to which software firm exports. The Tier I (top five software and services exporters from India, over $200 million sales in 2001-01), which account for nearly a third of software exports are primarily U.S. oriented (D'Costa, 2004). Government policy, competition, external environment etc. influence differently the firms in software industry. The kind of impact these

exogenous factors have, upon the software firms vary depending on the size of these concerns. For example, the big firms and to a lesser extent, medium firms could efficiently devise their marketing strategies overseas. Small firms, in this regard, have got comparatively little capability in keeping their customer-client relationship effectively, managing the marketing costs, setting up new ventures abroad etc. This is evident from the fact the Tata Consultancy Services (TCS) has office (near shore offices) in Budapest, Brasilia and Montevideo, Wipro has it in Dubai, Haninge and Kiel and Infosys has got office location in Toronto. (De, 2005). From the perspective of small-scale firms or a large number of medium size firms, setting up this kind of back-up facilities is almost unthinkable.

Different factors which influence the industry performance and the consequent export performance of different sized firms are analyzed in the following sections.

4.4.1 GOVERNMENT POLICY

To ascertain the impact of government policies upon different sized firms, the researcher calculated the mean score of opinions about the impact of government restrictions (G3), legal system in India (G4) intellectual property rights (IPR) regime (G5) and single window facility (G7). The following results were obtained:

Table 4.5 MEAN AND STANDARD ERROR OF OPINION ABOUT GOVERNMENT POLICY

Query No	Size	N	Mean	Std. Error
G3	Big	56	2.903	0.049
	Medium	73	3.985	0.143
	Small	154	4.508	0.128
G4	Big	56	3.885	0.081
	Medium	73	4.265	0.129
	Small	154	3.761	0.121
G5	Big	56	4.468	0.227
	Medium	73	3.620	0.114
	Small	154	2.318	0.143
G7	Big	56	4.1546	0.174
	Medium	73	4.2316	0.128
	Small	154	4.1815	0.127

Since the mean score for big firms is below 3, it can be concluded that they do not have a concrete opinion as regards the influence of government policy measures upon the growth of the industry. On the contrary, medium and small-size firms believe that the state machinery has got a big role in creating a competitive environment. The small firms agree more in this regard when compared to the medium firms. To check whether these three opinions differ significantly, an ANOVA (Analysis of Variance) test has been conducted. Therefore, it is concluded that the three kinds of firms have different view points regarding the role of government in the facilitation/ regulation.

Table 4.6 ANALYSIS OF VARIANCE TABLE FOR OPINION ABOUT GOVERNMENT POLICY

Query No		Sum of Squares	df	Mean Square	F	Sig.
G3	Between Groups	10.836	2	5.418	10.878	0.000
	Within Groups	139.456	280	0.498		
	Total	10640.069	282	37.731		
G4	Between Groups	2.846	2	1.423	3.272	0.046
	Within Groups	121.773	280	0.435		
	Total	7425.289	282	26.331		
G5	Between Groups	30.443	2	15.221	26.388	0.000
	Within Groups	161.512	280	0.577		
	Total	17368.757	282	61.591		
G7	Between Groups	.035	2	.017	.036	.965
	Within Groups	25.963	280	.481		
	Total	25.998	282			

Legal and commercial system in India is the legacy of British Colonial rule in India. Although reform measures to keep up with the changing ages could not be put into effect, the similarity this system has with that of Western legal and commercial system, has a number of advantages. It is opined in favour of the legal and commercial system's influence by all the three kinds of firms. The details are given in Table 4.6.

The similarity of the response was tested using an ANOVA. But it is found out that the opinions differ significantly. Although they are having different dimensions of opinion, all of them have agreed that legal and commercial system in India helps the cause of software firms.

IPR regime is a critical determinant in deciding the flow of capital, new start-ups, development of innovations etc. Many claim that there is a

high rate of piracy in India (Carmel and Tija, 2005). On the question of whether a system of weak IPR regime hampers the interests of firms in India, big and medium firms replied affirmatively. But the small firms expressed the opinion that their interests are not ruined by IPR regime in India. The researcher deduces that this difference emerged due to the small firms' concentration on services rather than products. This reason is complemented by another fact that piracy is mainly affecting the products of well-established firms. The result from ANOVA test indicates that the opinions differ significantly.

Single window facility is considered to be the most significant pre-requisite for the cause of software industry in the point of view of entrepreneurs. With the advent of Liberalization, Privatization and Globalization (LPG) the State had come forward with the mechanisms of decontrol and delicensing . But Indian entrepreneurs express their concern that getting the nod of different departments of the government for a new start up and getting licenses for this is a cumbersome and time consuming process. Therefore, a single window facility should be setup to provide the relevant information as well as assistance regarding the various procedures - legal and otherwise – that are to be complied with. (Ojha and Krishna, 2004). Recent evidence and literature suggest that there is definitely a role for the govemment in guiding the development of an industry. (Martinsons ,1998; Montealegre, 1999).

When opinion of the respondents was sought whether the absence of single window facility curtails the prospects of entrepreneurial activity in

India, all the three groups overwhelmingly observed that infrastructural and policy loophole curtail the prospects. The test of equality conveys that the opinions expressed by the three groups are similar.

4.4.2 MANAGEMENT

Management expertise of firms is seen and considered to be the backbone of software firms and industry. The success in management and the efficacy of management expertise could be witnessed in India's top IT firms like Infosys, Wipro etc. Out of the six questions framed, three are considered here. On the question of whether firms are run mostly by technicians (M2) who are deficient of proper management skill, the response has been affirmative. Small firms aggressively supported the statement. The magnitude of support was decelerating from small to big firms. Although all the three category of professionals answered positively, the degree of their favour varies significantly since the P- value for 'F' test is less than 0.05.

Table 4.7: MEAN AND STANDARD ERROR OF MANAGEMENT

Query No	Size	N	Mean	Std. Error
M2	Big	56	3.126	0.129
	Medium	73	3.440	0.129
	Small	154	4.044	0.137
M5	Big	56	1.511	0.150
	Medium	73	1.712	0.137
	Small	154	3.069	0.108
M4	Big	56	1.146	0.121
	Medium	73	1.402	0.131
	Small	154	1.587	0.159

On the question of organization culture or OC (M5) in corporate India, all the three sections responded against the intent of the query. All have disagreed that the OC hampers the prospect of software innovations and export. When analyzed on the strong disagreement, the OC in software industry in India is found to be very conducive to its development, as against the anticipated response of outdated organization culture. It is also understood that all kinds of opinions are of similar kind.

Big IT firms as well as medium IT firms opine that the state-the-art technology (M4) is implemented in India. Since this technology is not a backward one, this does not hamper the growth of software industry. On the other hand, the small firms responded positively that the inefficient adoption of technology is a crucial factor which obstructs the development of IT. It is analyzed from the 'F' test that all the three kind of opinions differ significantly.

Analyses of variance discussed in this section are summarized in the table 4.8.

Table4.8: ANALYSIS OF VARIANCE OF MANAGEMENT

Query No	Source of variation	Sum of Squares	d.f	Mean Square	F	Sig.
M2	Between Groups	3.625	2	1.813	3.720	0.031
	Within Groups	136.931	280	0.487		
	Total	8472.791	282			
M5	Between Groups	8.784	2	4.392	6.889	0.002
	Within Groups	179.139	280	0.638		
	Total	12228.093	282			
M4	Between Groups	0.933	2	0.466	1.052	0.356
	Within Groups	124.559	280	0.443		
	Total	7038.016	282			

4.4.3 COST

The competitive advantage in cost acts as a supportive mechanism for India's success in the export of software. India is a country which is known for cost effectiveness in the IT industry. **(Mehta, 1999).** Cost is an obvious, although diminishing factor. The table 4.9 gives the details of the comparative costs and revenues between India and the U.S.A.

Table4.9: SOFTWARE INDUSTRY ANNUAL WAGES (US $)

Type of Workers	U S A	India
Managers	98233	12200
Conceptualizers	68540	6750
Developers	58395	5360
Modifiers	39504	3827
Supporters	37885	2795

Source: **Data Quest**

As the Indian market, both domestic and export has boomed, the wage gap between Indian software professionals and their counterparts in the developed nations has started to narrow. Nevertheless, cost advantage remains substantial even today.

The constraints of venture capital create the initial hiccups in starting up a software firm. Since the success of a new firm depends on a number of externalities, the financial organizations rarely come forward to put their money into the investing in a new software startup.

Some studies have been undertaken revealing the structure of venture capital (**Arora and Arunachalam**, 2000).

Since the absence of venture capital is a serious factor constraining the setting up and proliferation of software development units, the researcher conceived the need for asking the query regarding the role of venture capital (C1). The query was that whether the absence of venture capital and seed money acts as a barrier. All the three different kinds of firms responded positively. Nevertheless, the small firms increasingly felt for a mechanism of availing ready venture capital. The following table reveals that the responses vary significantly.

Table 4.10 MEAN AND STANDARD ERROR OF OPINION ABOUT COST

cost	size	N	Mean	Std. Error
C1	Big	56	3.133	0.295
	Medium	73	3.035	0.147
	Small	154	3.807	0.094
C2	Big	56	3.832	0.056
	Medium	73	3.894	0.123
	Small	154	3.781	0.124

The second query has been whether the low remuneration is a factor which promotes the revenue addition from exports (C2). The participants replied affirmatively with almost a similar voice. All the groups agreed that the low remuneration adds to India's comparative advantage in software

development and export. ANOVA test reveals that they are all with the similar opinion.

Although, India enjoys a comparative advantage as regards the cost factor, the recent studies proclaim that this advantage is increasingly getting diminished because a number of developing economies have started to train their young manpower into the software expertise (**Chakraborthy and Dutta, 2002**).

Table 4.11 ANALYSIS OF VARIANCE TABLE FOR OPINION ABOUT COST

Query No	Source of variation	Sum of Squares	df	Mean Square	F	Sig.
C1	Between Groups	7.389	2	3.695	11.140	0.000
	Within Groups	92.865	280	0.332		
	Total	7134.351	282			
C2	Between Groups	0.142	2	0.071	0.158	0.854
	Within Groups	126.000	280	0.450		
	Total	6892.757	282			

4.4.4 QUALITY

It is India's strong reputation for quality software development that is earning it an outsize portion of the world's software requirements. Nowadays, a number of Indian software development firms are attaining quality certifications such as ISO 9000 or evaluation against the Software Engineering Institute's (SEI) Capability Maturity Model (CMM), to maintain their positions in the global market.

Two different questions regarding quality were delivered and the responses were collected. Whether the speedy delivery of services adds to the credibility of Indian companies (Q1) has been the primary question. Another query has been whether the quality certifications like CMM help Indian firms to accumulate export orders and revenue (Q3). The responses were analyzed together. The combined response could be analyzed to be exorbitantly highly positive. The ANOVA test revealed that the size is not counted to be a factor guiding quality since the responses did not vary significantly.

Table 4.12 MEAN AND STANDARD ERROR OF QUALITY

Size	N	Mean	Std. Error
Big	56	8.920	0.062
Medium	73	9.316	0.123
Small	154	8.900	0.121

Table 4.13 ANALYSIS OF VARIANCE TABLE OF QUALITY

Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.975	2	0.988	2.309	0.109
Within Groups	119.771	280	0.428		
Total	7070.856	282	25.074		

4.4.5 COMPETITION

The degree of competition is increasing in software sector. The Indian firms are increasingly facing competition from firms of Ireland, East European nations and those developing nations which are striving their level best to gain their own place in the map of global software development and export. India's comparative advantage in low labour cost is getting diminished. This shall be attributed to the expanding manpower with technical acumen from developing countries. "US firms are farming out jobs to China at a very high speed" quoted by an industry expert at the 2005 China IT Services Summit held at New York. (The Hindu Business Line, 2005) Competition shall be emerged on account of a number of exogenous/ endogenous factors, such as, increasing quality specifications, nature of innovation and diversification by firms, especially, large scale Research and Development (R & D) undertakings by MNCs, cultural/ language similarity and geographical proximity of some software developing nations to niche markets (for example, East European nations to the West) etc.

On the question of whether the Indian players face intensive competition (CP2), the firms of different size have responded almost alike in a positive manner. The response enlightens the fact that the competition between the firms of the same country (in this case India) reduces their prospects as well as profitability. This results in a sort of unhealthy competition which reduces the margins of Indian players. The significance test revealed the unanimity of the responses.

Another important query regarding competition has been pertaining to the competition put by countries like Ireland, Israel etc (CP3). India, along with, Ireland and Israel are categorized into '3Is' (Heeks and Nicholson,2002) since all the three nations are new emerging software exporting nations and included among 'First Tier' category of a 4- tier taxonomy (Carmel, 2003).

Table 4.14 MEAN AND STANDARD ERROR OF COMPETITION

Query No	Size	N	Mean	Std. Error
CP2	Big	56	1.571	0.239
	Medium	73	1.392	0.137
	Small	154	1.081	0.142
CP3	Big	56	3.137	0.097
	Medium	73	2.938	0.130
	Small	154	2.879	0.109

The average score obtained for this query has been more or less '3'. This indicates that although the competition level is not something which is to be neglected, a substantial degree of competition is not witnessed. The response to this query has been surprising in a way, contrary to the popular notion that these 3 major players were competitors among themselves. When churning out into the logic behind this reality, the researcher could find that the targeted specializations and areas where the three nations are oriented are different in their output. While India has been a major exporter of services, Ireland and Israel have been concentrating on high end services as well as products and packages (Carmel, 2003). Israel is considered to be

the world leader in security related packages (Avnimelech and Teubal, 2004).

Table 4.15ANALYSIS OF VARIANCE OF COMPETITION

Query No	Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
CP2	Between Groups	1.661	2	0.830	1.401	0.255
	Within Groups	165.927	280	0.593		
	Total	9492.442	282	33.661		
CP3	Between Groups	0.252	2	0.126	0.341	0.713
	Within Groups	103.443	280	0.369		
	Total	5696.846	282	20.202		

The significance test drew the conclusion that all the responses were similar.

4.4.6 EXTERNAL ENVIRONMENT

Globalization has ushered in a new era where the notion of self-reliance has become a myth. The theory of Comparative Advantage suggests the need for specializations for countries in different and specific areas of productions. Nowadays, countries are specializing in different areas and standardizing their products in these specific areas. This context is extremely relevant in the case of the software export of India. India is increasingly specializing in software innovation and development techniques and concentrating in export. The domestic market is not at all a well developed one (John, 2004). The variables affecting the economic

environment in other countries create ripples in the economic spectrum of the domestic system also.

The growth and development and increased sophistication of industry in the U.S. create opportunities for Indian software firms. Outsourcing has become the order of the day. (The Hindu Business Line, 2005)

Table 4.16 MEAN AND STANDARD ERROR OF EXTERNAL ENVIRONMENT

Size	N	Mean	Std. Error
Big	56	3.467	0.206
Medium	73	3.518	0.147
Small	154	4.026	0.139

On the question regarding the policy measures of overseas govemments(X1), the firms overwhelmingly replied that the policy interventions like visa policy of other nations diminish the interests of software players. The significance test conveys that the responses were similar for all the groups.

Table 4.17 ANALYSIS OF VARIANCE OF EXTERNAL ENVIRONMENT

External	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3.495	2	1.747	2.988	0.059
Within Groups	163.741	280	0.585		
Total	9890.740	282	35.074		

4.4.7 MANPOWER

A vast human resource with technologically sophisticated acumen is cited as a real strength of India's software success. The number of graduates, who attained qualified certifications from universities / other organizations, is increasing year on year (Singhal and Rogers, 2002).

It is argued by many scholars in their studies that in India, software talent is plentiful but experienced engineers and managers are deficient in number (Arora and Arunachalam, 2000). Project management expertise is said to be scarce in India. But this is because the industry is still young in India and large-scale projects where project managers are trained are still comparatively rare. But the situation is getting changed on account of the contracting of bid deals to Indian IT firms like TCS, Infosys, Wipro etc.

When asked whether at one extreme, experienced talents are rare(MP1) the response has been on expected line. The response of all the groups has been extremely positive. The ANOVA test signifies that the answers were analyzed to be similar.

Table 4.18MEAN AND STANDARD ERROR OF MAN POWER

Man Power	Size	N	Mean	Std. Error
MP1	Big	56	4.853	0.266
	Medium	73	4.220	0.164
	Small	154	4.158	0.108
MP2	Big	56	2.006	0.050
	Medium	73	1.787	0.104
	Small	154	1.972	0.119

When another query was put forth regarding India's strength of a large pool of fluent English speaking human resource (MP2), the respondents replied that such a reserve of English speaking manpower has been really a point of attraction. The significance test clarified that the opinions has been of similar nature for all the groups.

Table 4.19 ANALYSIS OF VARIANCE OF MANPOWER

		Sum of Squares	df	Mean Square	F	Sig.
MP1	Between Groups	1.744	2	0.872	2.068	0.136
	Within Groups	118.160	280	0.422		
	Total	6915.204	282	24.522		
MP2	Between Groups	0.410	2	0.205	0.516	0.600
	Within Groups	111.440	280	0.398		
	Total	6170.160	282	21.880		

4.4.8 INFRASTRUCTURE

Of the many supportive mechanisms entrepreneurs require, infrastructure is considered to be one of the most critical **(Motealegre, 1999)**. India has been substantially improving its infrastructure network, for the past one decade, even though many serious pitfalls are still conspicuous.

When faced with the questions that whether substandard telecommunications infrastructure (I1) and poor transmission quality (I4) curtail the growth prospects of ICT, the respondents argued that the said limitations constrain the growth prospects. Big and medium players

overwhelmingly supported the view that these are serious restraints, in comparison to the small firms. The significance test revealed that there was serious discrepancy among their opinions.

A query on the role and significance of software technology parks (I2) has been put forward. All the types of concerns agree that the crucial support given by STPs in the development and export is very obvious. It is also analyzed from the mean score of responses that small firms increasingly felt the need for such STPs. When ANOVA test has been done, what could be noticed was that there has been a substantial discrepancy in the responses of three types of firms.

Table 4.20 MEAN AND STANDARD ERROR OF INFRASTRUCTURE

Query No	Size	N	Mean	Std. Error
I1+I4	Big	56	9.217	0.146
	Medium	73	9.125	0.156
	Small	154	8.468	0.081
I2	Big	56	3.029	0.084
	Medium	73	3.449	0.124
	Small	154	4.157	0.138

A poor state of infrastructure is frequently cited as a reason which constraints the vast potential of Indian IT firms in delivering a global model. This is true to a great extent. However, a new dynamism is visible in the way of expanding index of infrastructure in India. For example, in November

2004, the government had announced its Broad band policy, which permitted the use of 2.4 GHz in outdoor locations. (Varma, 2005).

Table 4.21 ANALYSIS OF VARIANCE OF INFRASTRUCTURE

		Sum of Squares	df	Mean Square	F	Sig.
I1+I4	Between Groups	5.944	2	2.972	10.800	0.000
	Within Groups	77.046	280	0.275		
	Total	5866.335	282	20.803		
I2	Between Groups	8.720	2	4.360	8.054	0.001
	Within Groups	151.569	280	0.541		
	Total	10702.161	282	37.951		

4.4.9 INDUSTRIAL AND ECONOMIC SYSTEM AND ITS GROWTH

The role of the total industrial and economic system and its growth is highly critical in determining the growth prospects of software industry. When mechanical solidarity is replaced by organized solidarity (Durkheim, 1933), the complexity of social and economic system is increased. With increased complexity in the nature of tasks to be completed, the state-of-the-art technological innovation is a sine quo non. Computerization and up-to-date software development has to be taken place. Thus, in tandem with the mercurial rise in economic and industrial activities, the prospects of software development multiplies. "Policy initiatives for the sustainable development of firms need to focus on ensuring the supply of high quality recruits to industry from broad academic disciplines, supporting knowledge management and learning in teams and stimulating the domestic market by

the application of computer technologies in various economic and industrial segments (Millar, 1999).

When asked about the role of economic and industrial structure in India in the development of software industry (E1), the participants conveyed that the role of such a system is negligibly small. This is analyzed to be due to the low scale percolation of software products and services applications in the domestic economy. It is to be noted that small firms see more role in economic and industrial system, compared to the other two groups. The test of significance reveals that the opinions of firms differ considerably.

Table 4.22 MEAN AND STANDARD ERROR OF INDUSTRIAL AND ECONOMIC SYSTEM AND ITS GROWTH

Query No	Size	N	Mean	Std. Error
E1	Big	56	1.110	0.176
	Medium	73	1.999	0.167
	Small	154	2.417	0.119
E2	Big	56	4.471	0.150
	Medium	73	4.521	0.121
	Small	154	4.075	0.127
E5	Big	56	3.907	0.075
	Medium	73	4.404	0.129
	Small	154	4.267	0.133

A different opinion has been sought as to whether the pace of industrialization in other nations promotes the prospects of Indian software industry and its export (E2). All the three groups categorically supported the view that the external industrial activity and its growth help the Indian

players in boosting their export. The test of significance points to the fact that the three different groups have got the similar view.

Table 4.23 ANALYSIS OF VARIANCE OF INDUSTRIAL AND ECONOMIC SYSTEM AND ITS GROWTH

Query No	Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
E1	Between Groups	7.137	2	3.568	7.470	0.001
	Within Groups	133.761	280	0.478		
	Total	9287.282	282	32.934		
E2	Between Groups	2.475	2	1.238	2.642	0.080
	Within Groups	131.151	280	0.468		
	Total	7830.697	282	27.768		
E3	Between Groups	0.809	2	0.404	0.792	0.458
	Within Groups	142.904	280	0.510		
	Total	8000.040	282	28.369		

When their viewpoint has been sought regarding the impact effected by a low-profile electronics and hardware industry upon the software industry and export (E3), all the three groups overwhelmingly opined that the low profile sector retards the prospects of software in a big way. The test of equality shows that all of them have similar opinions.

4.4.10 MARKETING

Liaison building and marketing are considered crucial for software firms' export growth. India's domestic market for software is not an advanced one. Owing to this, the Indian players are much concentrating on the export. Although there was many an initial hassle, Indian player's marketing expertise is counted as efficient and substantial. The reason that

China lags behind India might be due to a lack of marketing acumen (The Hindu Business Line, 2005)

The first major question has been whether a small domestic market hampers innovation and software export of India (MK1). All the firms are of the similar opinion that such small size of domestic software market hampers the exports. One major factor being cited for the non-development of products and packages on a large scale by Indian firms is the absence of a big domestic market. (Arora and Arunachalam, 2000)

When asked about the level of marketing access of Indian companies (MK2), big firms were of the opinion that they have sufficient degree of market access to the export market. On the contrary, medium and small firms replied negatively. This shows that both medium and small sized firms face a number of marketing hazards in selling their products/services abroad. The test of equality reveals that the opinions measures were significantly different.

Table 4.24 MEAN AND STANDARD ERROR OF MARKETING

Query No	Size	N	Mean	Std. Error
MK1	Big	56	3.970	0.148
	Medium	73	4.121	0.115
	Small	154	4.463	0.128
MK2	Big	56	1.912	0.133
	Medium	73	3.459	0.134
	Small	154	4.300	0.121
MK7	Big	56	3.072	0.177
	Medium	73	4.065	0.123
	Small	154	4.182	0.113

When the response has been sought whether Indian firms are vehemently U.S. – concentric and discarding Europe and whether it affects its prospects (MK7), the replies suggested that the opinion sought has been right and in favour of the question. Both the small and medium firms supported the view more vehemently that overemphasis on the American market limits the scope of Indian players. The test of significance proves that the three groups are of different opinions.

Table 4.25 ANALYSIS OF VARIANCE OF MARKETING

Query No	Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
MK1	Between Groups	1.877	2	0.939	1.995	0.146
	Within Groups	131.729	280	0.470		
	Total	7693.550	282	27.282		
MK2	Between Groups	24.855	2	12.428	27.969	0.000
	Within Groups	124.417	280	0.444		
	Total	13775.739	282	48.850		
MK7	Between Groups	4.453	2	2.227	5.719	0.006
	Within Groups	109.007	280	0.389		
	Total	7184.186	282	25.476		

4.4.11 NON-ECONOMIC / CULTURAL VARIABLES

Non-economic variables influence the thinking capacity of the people of a nation. It is to be inferred that such non-economic and/or cultural determinants guide the way the development of software is made into effect. For instance, many political variables are said to be having even a direct relationship with the adoption of software in a society. Lacity and Hirscheim (1993) and Kem and Silva (1998) adopt political models to analyse outsourcing case studies.

Cultural issues can "make or break an offshore project" (Gupta and Raval ,1999). Many studies have analyzed various elements of national culture and their influence on the process of information systems development and use (Ein Dor, Segev and Orgad, 1992). They had developed a list of national cultural variables that affect information systems development.

When asked to the respondents whether India had an innate aptitude towards logical thinking and programming (NE2), all the three groups replied positively. The test of equality conveys that all the three groups are having unanimity in their outlook.

Another query has been regarding the influence of the spread of political and religious dogmas upon the Indian society and the consequent impact upon the modernization efforts like computerization (NE3). The respondents from all the groups observed that such political and religious doctrines adversely affected computerization and software upgrading in

Indian economy. The test of significance points to the fact that every groups were having the similar viewpoints regarding this.

Table 4.26 MEAN AND STANDARD ERROR OF NON ECONOMIC/ CULTURAL VARIABLE

Query No	Size	N	Mean	Std. Error
NE2	Big	56	3.9815	.06461
	Medium	73	3.8319	.15747
	Small	154	4.2382	.11264
NE3	Big	56	4.0967	.24862
	Medium	73	4.1590	.15435
	Small	154	4.0638	.13574

Table4.27 ANALYSIS OF VARIANCE OF NON ECONOMIC/ CULTURAL VARIABLE

Query No	Source of Variation	Sum of Squares	d.f	Mean Square	F	Sig.
NE2	Between Groups	1.911	2	.955	2.252	.115
	Within Groups	22.902	280	.424		
	Total	24.812	282			
NE3	Between Groups	.101	2	.051	.088	.916
	Within Groups	31.002	280	.574		
	Total	31.103	282			

4.5 MULTI DIMENSIONAL SCALING

By employing a key univariate analysis viz ANOVA in the context of the various guiding factors and variables of software industry and export,

the researcher could obtain the first hand information regarding the determinants behind software industry's mobility and also the fact that how far the size of firm matters when it comes to these determinants. The various similarities/dissimilarities between and among variables could also not be identified when ANOVA was exercised. In this context, it is thought that a multivariate statistical technique called 'Multi Dimensional Scaling' (MDS) can aptly be used in locating the similarities/ dissimilarities.

The purpose of MDS is to provide a visual representation of the pattern of proximities (ie, similarities or distance) among a set of objects. MDS is a mathematical procedure by means of which information contained in a dataset can be represented by points in a space. MDS finds a set of vectors in a p-dimensional space such that the matrix of Euclidean distances among them corresponds as closely as possible to some function of the input matrix (ie, matrix of similarities or dissimilarities) according to a criterion function called 'stress'. Stress is a measure of the lack of correspondence between the distances among points implied by MDS map and the input matrix.

MDS is primarily concerned with the representation of objects as a configuration of prints, usually in two dimensional maps, in such a way that maximizes the fit between the proximity measures of each pair of variables and the distances between all of them in the map.

There are two types of multidimensional scaling models: Metric and Non-metric.

For N items, there are M = N(N-1)/2 similarities (distances) between pairs of different items.

The observable random vector X, with p components, has mean μ and covariance matrix Σ. The factor model postulates that X is linearly dependent upon a few unobservable random variables F_1, F_2 ..... F_m, called common factors, and p additional sources of variation Σ_1, Σ_2 .... Σ_P, called errors or, sometimes, specific factors. In particular, the factor analysis mode is

$X_1 - \mu_1 = l_1, F_1 + l_{12}F_2 + ... + l_{1,m} F_m + \Sigma_1$

$X_2 - \mu_2 = l_{121} F_1 + l_{22}F_2 + ... + l_{2,m} F_m + \Sigma_2$

$X_p - \mu_p = lp_1, F_2 + l_{p2}F_2 + ... + l_{pm} F_m + \Sigma_p$

Or, in matrix notation,

$X_{(pX1)} - \mu = L_{(pXm)} F_{(mX1)} + \Sigma_{(pX1)}$

The input data and consequently the MDS solution are invariably subjected to substantial random variability .Hence an assessment of the reliability and validity of MDS solution is carried out. Reliability comes to the forefront when variables developed from summated scales are used as predictor components in objective models. Since summated scales are an assembly of interrelated items designed to measure underlying constructs, it is very important to know whether the same set of items would elicit the

same responses if the same questions are recast and re-administered to the same respondents. Variables derived from test instruments are declared to be reliable only when they provide stable and reliable responses over a repeated administration of the test. Cronbach's alpha is an index of reliability associated with the variation accounted for by the true score of the underlying construct. Construct is the hypothetical variable that is being measured (Hatcher, 1994).

Table 4.28 RELIABILITY STATISTICS

Cronbach's Alpha	N of Items
0.826	15

Since the Cronbach's Alpha is high we can conclude that the fifteen items considered for the analysis are reliable.

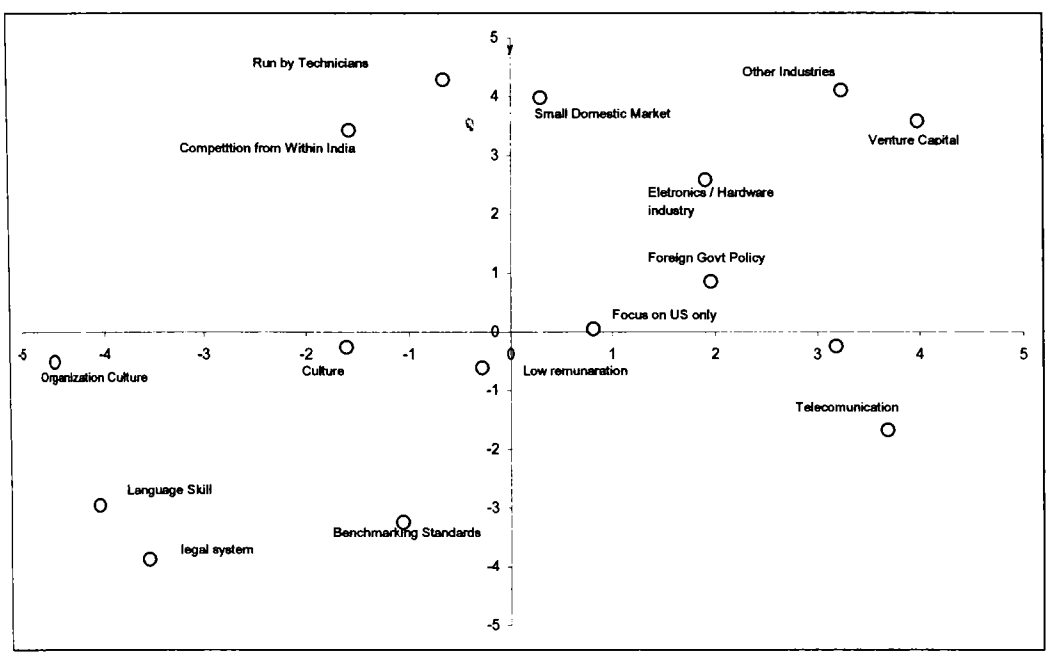
The precision of the multidimensional analysis is determined by two quantities -Stress and R square value. The stress value is an indicative of quality of MDS solution, but stress measures badness of fit, or the proportion of variance of the optionally scaled data that is not accounted for by the MDS model. Stress value of 0.05 and below are considered as acceptable for a good MDS. The index value or R square is a squared correlation index that indicates the proportion of variance of the optimally scaled data that can be accounted for by the MDS solution. Thus, it indicates how well the MDS model fits the input data. R square is a measure of goodness of fit. Higher values of R square (values above 0.95) are desirable.

For this study

Stress = 0.04390

R Square = 0.98834

Figure 4.1 MULTIDIMENSIONAL SCALING DIAGRAM OF FACTOR IMPACTS



Fifteen major items that influence software industry and exports could aptly be employed in the multidimensional scaling diagram of this study. Those items that have higher loadings on both axes shall be considered to be important. Those items which bear high loads only on one axes are having comparatively lower influence on software export. On the other hand, those which have negative loading on both axes are having the minimum of impact. Having drawn the MDS diagram, those factors such as, venture capital, low profile of electronics / hardware sector etc are having higher loadings so that they are considered to be having greater impact on the

software industry and export. The medium category factors which appear on the second and fourth quarters such as substandard telecommunication and infrastructure and management by technicians are important but not as important as a factor like the low profile nature of electronics. Among all the factors which have been discussed, the items such as language skill, legal system etc are having the least impact upon the whole of software industry, export and its competitiveness

Chapter

5

INDIAN SOFTWARE:

EXPORT GUIDING FACTORS MODEL

INDIAN SOFTWARE: EXPORT GUIDING FACTORS MODEL

5.1 INTRODUCTION

India's is a case of success story being imitated by many a nation. A detailed examination into the success factors shows some variables which are determining. Different scholars had tried to analyze these factors and some of them had even created suitable models. One such model is the 'Oval Model' (Constructed by Carmel, 2003). It could be understood that eight major factors were delineated in this model.

Another model has been developed to indicate the export performance of Indian software industry (Heeks and Nicholson, 2002). This model incorporated five success factors. There were some nascent attempts to model the success factors of leading software exporting nations from the beginning of 1990s onwards. An important milestone in this regard was Michael Porter's Model (1990) of competitive advantage of nations that posits four critical factors. An important categorization of nations based on four important criteria could be seen in World Bank report (Garry, 1999). He identified four criteria – cost, English speaking ability, ease of doing business and segment expertise. In a different approach two important factors were identified in a study (Porter et al, 2001) viz, socio economic factors and national orientation, the other two factors being technological infrastructure and production capacity. It was named the High Tech Indicators Model by the authors.

5.2 HISTORIC MODELS: A CRITICAL APPROACH

Michael Porter's model (1990) of competition advantages of nations, even though it was a nascent attempt, had tried to find out the crucial factors that lead into success in software exporting. But it was found out that the approach he adopted in this regard was more general than specific. The model did not delimit its scope to the export spectrum alone. Rather, it had been pulled to give application to a national industry's resolve to achieve global leadership over an extended period of time

World Bank Report (Garry, 1999) was not a model in itself. But he has specifically selected some important criteria for categorizing software exporting nations. An important drawback of this study is that it lacks a systematic approach. Though important factors were highlighted, the whole at one hand and the synergic interaction of these four factors on the other hand were ignored. For example, cost as criteria could be demarcated as the credential for China. But it is to be noted that cost factor alone will not contribute towards a nation's success in its exports – especially in a hi-tech industry like software.

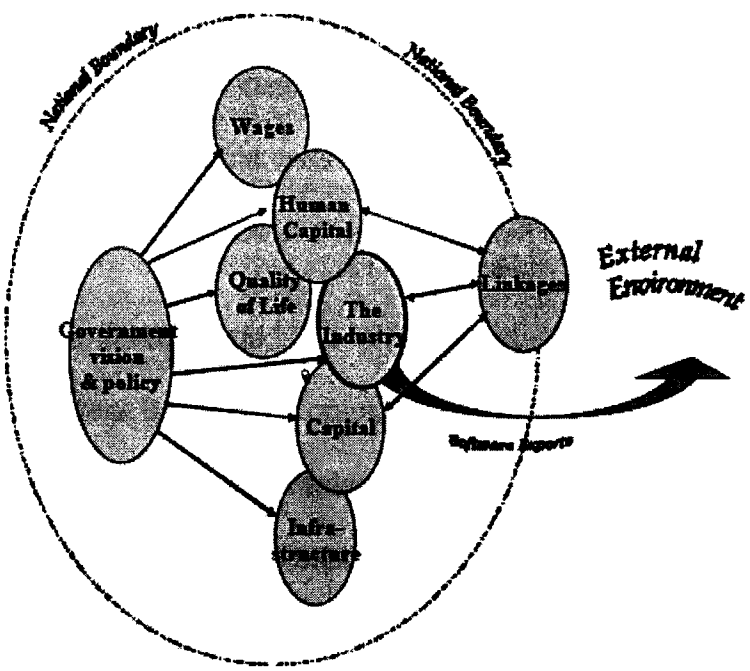
An outstanding feature of the High Tech Indicators Model (Porter et al, 2001) is that it has depicted important criteria like socio-economic factors. The study has taken the subject in a macro approach. Both the cultural as well as structural factors could be taken into account in this

model. But it is worth mentioning that the approach adopted in the study was abstract rather than concrete.

Perhaps the most comprehensive model, for evaluating national software industries is the Software Export Success Model (Heeks and Nicholson, 2002). This model has already been applied to depict the software exporting success phenomenon of a number of new software exporting nations (Nicholson and Sahay, 2003). The authors developed the model from success factors of India, Ireland and Israel, the success cases of 1990's. The five factors are: demand (for software); national software vision and strategy; international linkages and trust; national software industry characteristics; and national software related infrastructure (Heeks and Nicolson, 2002). The model envisages almost all the important factors leading to software export success. As well, the study scripts the need and necessity of the production of high-end services as well as the need for innovative products and packages in order to be a global leader. But it has not spelt in detail how the transition shall be made possible from the exporter of low-end services to an exporter of high-end software products, packages and services. Also, this model cannot aptly be emulated in case of 3rd and 4th tier software exporting nations (Carmel, 2003).

The "Oval Model" constructed by Carmel emphasized on eight important factors, government vision and policy, infrastructure, capital, industry, quality of life, human capital and linkages.

Figure 5.1 THE "OVAL MODEL" DEPICTING NATIONAL SOFTWARE EXPORT SUCCESS FACTORS



The study has described all these factors in detail. But the industrial and economic system and its growth and the concerned 'cascading effect' it generates could not be spelt out in any of these studies including the 'Oval Model'. For instance, without the emergence and growth of industries like steel, air traffic, banking etc, there could not have been any need of these software packages and solutions. Notably, the change and growth in one sector of either the national economy or the overseas economy will have its cascading effect on other sectors as well, including the software. This aspect which is one of the most relevant factors influencing software industry and export is almost comprehensively ignored by these studies. This major short coming is reflected in the aforesaid models since it did not incorporate this vital component.

Almost all these works have tried to explore the effect produced by various factors on the total export output of software. They could clearly notice many of the relevant aspects of cause. How ever, it is to be specified that none of these studies could specifically measure or quantify the marginal effect of one variable over the other or the combined effect or interactions of different variables and factors upon the whole.

Against this background, this chapter attempts to answer to the following issues. What is the most crucial comparative advantage India has or will have? What are the factors which influence the innovative performance of different software exporting units? What is the effect of one factor upon the other? What sort of dynamism is to be effected to achieve the targeted goals? Has any important factor/ variable not been considered when the study of software export of India or such emerging software exporting nations was undertaken? How is it possible to measure each and varied factors which determine/influence the competitiveness of software export?

5.3 DYNAMISM IN THE STRUCTURE OF SOFTWARE EXPORT: MULTIPLE FACTORS

The much popular jargon of India Model of software export success is to a great extent, ironical. There are instances of a few countries like the United States with a high level of IT diffusion with around 400 computer per 1000 people, where IT contributes substantially to its economy (Pohjola, 2002). On the contrary, there are many a developing nation where the extent of IT diffusion is minimal and superficial. Such a 'digital divide' or

'technology gap' can best be summarized by the fact that 'more than half of humanity has never made a phone call' (Pohjola, 1998). Thus it seems paradoxical that India enjoys enormous comparative advantage in the export of software. The available statistics show that, during the last decade software export from India recorded annual compound growth rates of over 60 percent in rupee terms (at current prices) and around 45 percent in dollar terms. In consequence, the share of software export in the total export earning of the country increased from 1.9 percent in1994-95 to about 20 percent in 2002-03 (Parthasarathy and Joseph, 2004). This phenomenal growth India recorded in software export volume and export competitiveness lead to the following governing factors. They are:

a) Government policy and the resultant economic environment

b) Infrastructure

c) Industrial and Economic system, and its growth

d) Competition

e) Man power/ Skill

f) Marketing

g) Cost

h) Credibility/ Quality

i) Management

j) External Environment, and

k) Non-economic/Cultural variables

5.3.1 COMPETITION

Economic reforms initiated in India in 1990s had a direct impact on competition. Globalization compelled the Indian firms to compete with their counterparts in other parts of the world and since software industry has got more of an international connotation than a domestic one, the opening up of the economy had many positive aspects. Increased competition helps these firms to become gradually global. Broad economic reforms are compelling Indian business to respond to increased competition (D'costa, 2000). The impact of economic reforms upon other industries had its ripple effects on software industry. For example, Indian banks started increasingly adopting IT for competitive advantages. The adoption of such competitive practices in all other sectors is contributing to diffusion of IT.

Product innovation will assist the Indian industry to diversify domains and markets to preserve and enhance its competitiveness (D'Costa and Sridharan, 2004). A shift from low-value service exports to an innovation driven higher value added trajectory will boost the competitiveness and an increased market capture. A paradigmatic shift in corporate strategy will enable this. This shift is expected to lead to diversification also. The positive impact that it will render Indian firms truly global and competition among the domestic software firms will get marginalized at least in the short run.

Different kinds of 'de-coupling' also harmfully reduces the competitiveness of software industry and its export of emerging software kings especially India. Four forms of de-coupling were identified. They are:

a) Between software and hardware.

b) Between the export and domestic markets.

c) Between software services and products (D'Costa , 2004)

A fourth type of decoupling could be noticed, ie, the decoupling between the civilian sector and national security sector (Sridharan, 2004). The synergy which could have been created has not effected on account of these four kinds of decoupling, which happened in India.

There is an argument that the low-profile of electronics and hardware sector in India retards the prospects of software. It is already discussed that the decoupling between the software and hardware had its negative impact. Computer hardware industry has not grown significantly in India. It is very clear from the fact that even now, IT diffusion remains low in India. A strong foundation of hardware sector and its bullish sectoral growth would have laid an infrastructural base for software. That would have resulted in a mighty software industry. It can be stated that such fundamentally strong domestic market augurs well for its software export market. But there are stark exceptions in this regard. Mexico and South Africa have a solid software industry with potential for exports, but internal domestic demand has been too strong, inhibiting growth of a national export sector even when other success factors are present (Carmel, 2003). However, what is understood is that with a strong motivation for export which caters to overseas demands, supplemented by developed domestic hardware and software market, software export will get benefited.

The business by the MNC sponsored software development centres established in India is gathering momentum. Whether they are competitors to Indian origin companies are to be carefully studied. However, they are contributing significantly to India's export revenue. During the financial year 2004-05 IBM GSI and HP GDIC had exports to the tune of Rs.1950 crore and Rs.1056 crore respectively(Dataquest,2005). Three companies, viz; IBM GSI, Cognizant (IDC operations) and HP GDIC make it to the top 10 software and services exporters and another four firms, viz; Oracle(IDC operations), Accenture (IDC operations), Texas Instruments and Perot Systems TSI make it to the top 20 exporters (Dataquest, 2005). It is certain that competition is encompassing in today's market driven global economy. One or another form of competition will prevail any time and every time. The Indian software houses are to be well prepared to face this competition.

5.3.2 GOVERNMENT POLICY

Government policy is counted as one of the most vital aspects for the emergence and growth of any industry. It is of prime importance in those industries where there is a case of evolution of innovative capability. For instance, in manufacturing, the East Asian governments have successfully fostered high-tech competitive industries through a wide range of fiscal and non-fiscal policy instruments (Dedrik and Kraemer, 1998). Whereas, the protectionists policies followed in India and Brazil hindered the growth of such industries to become innovative and globally competitive. In the Indian context, in the computer hardware sector, restrictive policies compelled several Indian firms to use limited imported know-how. It was termed as 'green-house

approach' where in such firms were forced to build their own computer hardware but the growth was hampered (Evans, 1995).

The economic reforms and market liberalization had tremendous impact on different industries including the software industry. Most Indian hardware manufacturers had to abandon the aforesaid line of business (D'Costa, 2004). The kind of fatigue of the government in regulatory intervention had its favorable impact on the software industry. Unlike those sectors which are still heavily relying upon captive market and state protection, the software industry is internationally competitive.

Instead of being a regulator, the state can act as a facilitator. The Information Technology Act which was enacted in June 2000 shall be considered as a promising initiative. The Act provides legal recognition for transactions carried out by means of electronic data interchange and other means of electronic communication. The Act is the first step in the amalgamation of the Internet into India's legal framework (Data quest, 2002)

Infrastructural support like data communication links, tax free export income, duty free imports for the value of exports etc. are tools as well as products of state facilitation.

The free-market guidelines of the New Economic Policy (NEP) eased government controls on importing technology, foreign currency and on raising capital (Singhal and Rogers, 2000). The NEP also invited competition for Indian companies from multinational corporations.

The role of the government is significant in building technopolis since it is seen as an accelerator of innovation as well as software business. The experience of technopolises around the world indicates that collaboration between government, private corporate houses and research centres of universities is essential. For instance, the Austin technopolis arose because administrators in the Texas state government, at the University of Texas, and in private companies agreed to collaborate in building a technology city (Gibson and Rogers, 1994).

A significant support the entrepreneurs need from their environment is financial, particularly in the early days. In 1999, the Indian government established a $25 million venture capital fund especially to encourage software start-ups. Venture capital investments in Indian high tech companies grew from $20 million in 1996 to $750 million in 2000, and are expected to rise steeply to $10 billion by 2008 (Padmanabhan, 2000). Most start-ups do not have the assets that a traditional investor would consider valuable. The entrepreneurs, therefore, have to rely on their own resources. They have little to offer investors besides their hopes and dreams (Bhide, 2000). But one major drawback which could be noted is that the venture capital is neither availed of to the entrepreneurs nor utilized by them. It is noticed in such a way that personal funds remained a key source of availability of funds for start-ups (Manimala et al, 2001).

One of the needs most consistently emphasized by entrepreneurs was a single window that would facilitate on all government-related requirements to enable the entrepreneurs to concentrate comprehensively on their business

and also remain within the legal system. A single window facility for an industry (in this case, software industry) should be set-up to provide all the relevant information as regards the various legal procedures that are to be complied with and remove all the hiccups. A major complaint which is being heard is the level of corruption in all the departments of government machinery (Ojha and Krishna, 2000). Therefore, it seems very necessary that the government simplify its procedures so that entrepreneurs are easily able to comply with them without being harassed by government agencies for violation that they were unaware of.

A significant number of people have strongly argued against the role of government in the economy (Ojha and Krishna, 2004). Some evidence and literature spell, however, that there is a vital role for the government in guiding the development of an industry (Martinsons,1998; Montealegre,1999). Official machineries/ government can attempt in delivering an efficiency – promoting environment by making various resources available, increasing the multitude of opportunities, and most significantly, avoiding policies that create real or perceived obstacles (Chen, Greene and Crick, 1998).

It is reported that, while India did not have the lowest scores on various elements of government policy and programs for new firms evaluated, it ranked below the average of the twenty-nine countries on every element (Manimala et al, 2001). Hence it is very clear that the government has a lot to do to encourage entrepreneurship in India.

A relatively decent economic system facilitated and augmented by the government and comfortably better standards of living can help minimize the

cause of brain-drain from India. It is to be noticed here that the project management expertise which is locally available can set international quality standards for Indian software and save billions of rupees.

The concerns over a system of weak Intellectual Property Rights (IPRs) should be addressed by the government. Proper legal measures are necessary to tackle privacy ills and a constructive mechanism of intellectual property rights has to be in place (John, 2004). Similarly, even though the hiccups of political instability cannot be tackled overnight, the state should embrace a system which facilitates the cause of the industry on a sustainable basis irrespective of political uncertainties and turmoil.

The government also can play a role in creating a brand image for the Indian software industry. Smaller entrepreneurs as well as intrapreneurs need to be benefited from the collective goodwill of the software industry. The co-ordination by the government with a motive of facilitation rather than interference will, in any way, help this industry.

5.3.3 INFRASTRUCTURE

The role of infrastructure is unambiguously vital in the point of view of any industry. It shall be described as the backbone of any industry. The role of infrastructure, whether it is physical infrastructure or financial infrastructure, is paramount in a high-tech industry like software.

Infrastructure is one of the most important of support mechanisms entrepreneurs require (Cabral, 1998; Martinsons, 1998; Montealegre, 1999 and Sanchez and Perez, 1998). This may range from Research and

Development (R & D) centers to financial infrastructure like a sound system of banking. The scope of infrastructure extends to physical infrastructure such as technology parks to adequate roads, telecommunication facilities, and the like that are essential for doing business. Manimala et al, (2001) report that India had, on average, the lowest scores on adequacy of physical infrastructure among the twenty-nine countries they surveyed.

Industrial infrastructure is a precursor for production, with necessary ingredients of any industrial infrastructure including power, water and transport. Of more specific interest to the software industry is the provision of a tele-communications infrastructure; 'the central transport network of the world information economy' (Feketekuty and Aronson, 1984).

In India, this was in a poor state, for much of the 1980s. This was evident in many literatures. 'Communications in India are best not described. With perhaps the world's most inefficient telephone system you can safely forget about facsimile, networking, electronic mail or any kind integrated services for quite some time to come' (Business India ,1986).

Software firms, particularly, export units faced with a number of structural ills like scarcity or even non-availability of actual telecommunication links, substandard transmission quality and exorbitantly high expenditure of installation and use. Overall growth of Indian software exports was stunted consequently. Foreign clients viewed offshore software development as unacceptably problematic.

However, from the mid – 1980s, the government of India started giving priority to the telecommunication infrastructure. Investments in international links alone was raised from US $ 150m for 1985-1990 to US$ 200m for 1990-95 and overall spending was intended to rise by 15 percent annually between 1990 and 2000 (Heeks, 2001).

A number of policy initiatives were undertaken by the state machinery in its motive to create and lay down quality infrastructure. A number of software technology parks were established. These were aimed to provide high-speed (64 kbps) satellite links and Satcomm Services, which provided the 'last mile' local connection through microwave and radio links. They reduced the costs of a high- speed link from around US$ 1,80,000 per year to an internationally competitive level of US $ 60,000 making it a feasible option for more companies (Heeks, 2001).

It took off following the Prime Minister's 1998 IT Task Force and its 108 recommendations. Two–thirds of these recommendations finally saw the light of day (Data quest, 2002).

It is quite difficult to narrate the entire story of infrastructure building in India. Still some policy changes demand special attention. The 2001 Convergence Act was such an important milestone. "And a series of policy changes, and the 2001 Convergence Act which spoke little of Convergence, but did replace the cobwebby 1885 Telegraph Act, with its separate rules for voice and data. Also, there has been the convergence of the telecom and IT ministries in 2001 (Data quest, 2002).

It is a certainty that the tele-communications facilities that are at the doorsteps of industry have improved considerably. But these infrastructural prerequisites are considered to be still inadequate. The entrepreneurs want the government to improve these facilities, or to enable private players to provide such facilities.

Service-oriented firms themselves have been successful despite the infrastructure, and not because of it. As of now, infrastructure at the technology parks is more affordable to service-oriented firms, and not to entrepreneurs on a very tight budget in the initial phase (Ojha and Krishna, 2004). Making smart gains in infrastructure front would give further fillip in the attempts to create a brand image for Indian software industry.

5.3.4 INDUSTRIAL AND ECONOMIC SYSTEM AND ITS GROWTH

Industrial and Economic System (IES) and its growth might be considered to be the most important determinant for the development of software industry, its expansion and competitiveness. Although this is macro-economic in nature, the attitude of the government and its policies, especially fiscal policies have a great say in this front.

Software industry does not have its existence, independent of the growth and existence of other industries. This is primarily because software industry basically acts only as a supportive mechanism.

Since competition is the buzzword in this era of globalization, software support is gravely in need for firms of different industries to

become internationally competitive and to simplify their complex tasks. However, if there would have been no growth and expansion in other industries, software industry alone would not have grown. Therefore, IES and its growth pattern is seen definitely critical, even though it has more of an indirect impact than a direct one.

5.3.5 COMPETITION

The present world economic system is characterized by hyper-competition mostly among Transnational Corporations (TNCs) from the Triad Nations/blocks of the USA, E.U. and Japan. A handful of nations, such as South Korea, China, India, Brazil, Taiwan and Singapore, are striving to upgrade or expand heir industrial activities and core competencies. The rest of the developing world compete either vigorously in labour-intense export or are considered 'structurally irrelevant' (Hoogvelt, 2001). Of the $12.4 trillion of global trade, the capitalist countries of the developed world had a share of 65 percent, while the least development countries, most of which are from Africa, had a mere 0.64 percent (UNCTAD, 2002).

U.S. Multinational Companies (MNCs) affiliates in five IT industries had global sales of $202 billion, while total U.S. exports of IT goods and services was only $113 billion in 1998 (U.S. Department of Commerce, 2002)

The structural inequality is evident from the size of firms .

Table 5.1 SIZE OF FIRMS AND THE STRUCTURE OF THE WORLD ECONOMY (AVERAGES OF TOP 10)

Top 10 manufacturing MNCs (global) (1999)	$ 134 billion
Top 10 manufacturing MNCs (developing countries) (1999)	$ 24 billion
Top 10 ICT* firms (Global) (2000)	$ 63.4 billion
Top 10 software firms MNCs (Global) (2000)	$ 5.9 billion
Top 10 Indian IT firms MNCs (2000) **	$ 278 billion

Source: **UNCTAD (2001) for top manufacturing firms;**

OECD (2002: 63, 67) for top ICT and software firms;

Dataquest (www.dqindia.com/top/201) for top Indian IT firms

Competition at the international level suggests that not all firms can pursue successful activities. Rather, outsourcing, joint ventures, subcontracting, technical collaborations and alliances are institutional arrangements by which firms will try to specialize (Okhi, 2001). Except in case of customized service, Indian software firms have failed to specialize, even though there are genuine attempts to get rejuvenated in other areas of products and packages as well.

Core competence is the buzzword here. Lacking core competence in different aspects of product innovation, upgrading and marketing contributes towards the failure of firms, especially in case of India. However, it has another side as well. With almost muted infrastructure, Indian software exporting firms could create a good brand image of their own, although it is

manifested in low-end services. This was the case of India. Core competence and the absence of it divides the industry into two dichotomies. This is where the competition is manifested in second turn. Lacking core competence of a high technological order, most small firms are adjuncts to larger enterprises. For instance, in Internet software development, smaller firms adjust to the standards set by the giant telecommunications companies, while applications software developers are further down the industry hierarchy (Casper and Glimstedt, 2001).

In a transnational perspective, the convergence of MNC attention on core competence helps the firms of developing nations. This means that MNCs farm out non-critical, labour-intensive, low end activities to other suppliers, who are mainly from developing countries. Why MNCs do this? This is found out that these activities are out of synchronization with MNC core competence. (U.S. Department of Commerce, 2002). There is an argument that it offers plenty of opportunities to firms from countries like India. This is right with a short-term perspective in mind. However, over a long duration, this may prove to be a casualty. The software exporting firms from countries like India as well as Business Process Outsourcing contractors will increasingly compete among themselves. This has two negative impacts. a) The economies of scale will be diminishing from the point of view of service providers like Indian IT firms since they are competing among themselves, not with their peers in developed countries, and b) They will ever remain a low-end service provider.

5.3.6 MANPOWER/ SKILL

The steady supply of qualified software professionals has added to the success of software exporting firms in India. The software industry is characterized by low physical and high human capital intensity (Mowery, 1999). Human capital in software sector encompasses the collective characteristics and abilities of its software professionals: national orientation and traditions, quantity, composition, language skills, and managerial skills.

A sufficiently large pool of skilled manpower is considered to be the most important asset for Indian software industry. Since the present concentration of India's software industry is in the segment of 'services', the role and significance of human capital is crucial.

For any national industry to develop through different stages of maturity there is a need for a balance of entrepreneurial and professional human capital (Iyigun and Owen, 1998). Entrepreneurial human capital is the collective capacity of an industry, contributed by the entrepreneurs, to perform unconventional and innovative things that meet the needs and expectations of market (Ojha and Krishna, 2004). They provide an industry with ideas, services and products. Professional human capital refers to the technical capacity of an industry to be involved in a particular technology domain. While entrepreneurs provide some capital and ideas, it is the professional human capital which provides the required know-how and skills.

Entrepreneurial as well as professional human capital have to complement each other for the firms of any industry to succeed in, the role of entrepreneurial human capital is more significant than the professional human capital.

Some studies provide to the importance of cultural capital (Pierre Bourdieu 1977). The author, however, in later years accentuated the importance of economic capital. He categorically declared that the economic capital is more critical than the cultural capital.

In an economy in which economic activity is low, entrepreneurial human capital is critical to initiate economic activity to enable professionals to get gainful employment. The lack of entrepreneurial human capital in the early stages of development is one of the explanations provided for the failure of former East Bloc Economies to develop globally competitive industries despite a highly educated labour force (Ojha and Krishna, 2004) However as economic activity grows, although there will be a growth in the number of entrepreneurs, the ratio of entrepreneurs to professionals normally declines (Iyigun and Owen, 1988) and the role of entrepreneurial human capital is less critical.

Much of the success of the software industry in India shall be attributed to the availability of a low cost well qualified workforce that can speak and work in English (Correa, 1996). However, there emerged a number of concerns about the sustainability of Indian software growth. Many reasons are pointed out in this regard. For instance, a substantial part of exports is based on low end programming (Abraham, Ahlawat and Ahlawat,

1998). The recommendation to the software industry to address many of these concerns is that firms to move up the 'value chain (Abraham, Ahlawat and Ahlawat, 1998; Kumar, 2001). There is significant professional human capital available in India to allow the software industry to move up the value chain. However, there is a dearth of entrepreneurial human capital in India. It prevented India from playing any major role in global industry map, software industry being no exception.

Although India has seen a spurt in the new entrepreneurial ventures, the number of software ventures is still considered to be scarce, in the face of increasing global competition. While software entrepreneurs from India have been successful in Silicon Valley in the US, very few have been returned to India to start firms (Saxenian, 1999). For leading in the next generation software business, the need for human capital-both entrepreneurial and professional is highly required.

As already specified, one major problem faced by Indian software industry is the low-value output. It is felt that programmers are plenty, but the experienced talent in system analysis, networks administration etc. is not found to be encouraging in number. However, the gradual shift from on-site to off-shore development is indicative of greater skill-based activity providing the Indian developers with increased autonomy.

5.3.7 MANAGEMENT

Skills in management are seen as a basic pre-requisite for the success of a business including software industry. The management tasks

are critically correlated to not just the marketing activities but extends to a large number of arena like setting up, funds flow, primary and secondary market activities, innovation, strategy in product/service orientation, diversification, liaison with overseas firms etc.

A core aspect of the management capability is innovation. Innovation is a multifaceted phenomenon covering not only technological innovation but also institutional, organizational, associational, communal, financial and managerial innovations, and their endogenous and exogenous support system. Management capability with a dynamic innovation attitude is vital in different dimensions. It is most important in the sense of creating capability to match technology with specific customer requirements. The task of the management encompasses a whole range of activities like backward integration, core product development, forward integration, after sales service/service-post service etc. The key strategic management tasks are to find and maintain a stable product and/or service niche, find or create new product and/or service niches, and absorb user experience to continue to match technology to user needs and maintain/ create stable new product and/or service niches (Sridharan, 2004).

Although management capability is seen as a vital ingredient, different opinions emerged regarding India's potency in this regard. Some studies say that in India, management capability is a weak one. It is argued that many of the existing firms will fail the challenge of moving beyond low-end services (Arora and Arunachalam, 2000). However, they also claim that this should not be a major problem for the industry as a whole because

some Indian firms are already looking outside of their boundaries and even outside India to get the managers they need.

It is also pointed out that project management expertise is scarce, in the case of India. It is claimed that it is because the industry is still young in India and large scale projects where project managers who are trained are still relatively rare. This problem is exacerbated by a large number of experienced professionals who emigrate to the U.S.

Management expertise is vital for entrepreneurial ventures to succeed. Management expertise is expected of an entrepreneur. Traditional entrepreneurs were financiers cum managers. However, today's entrepreneur-manager is one who should have awareness as well as experience as regards all the different aspects of a business. This has got special significance in software industry. Prior work experience adds to the management expertise. Lack of experience is a limitation, as indicated by Bhide (2000) and Sanchez and Perez (1998).

Conventional management theories based on studies of large organizations need to be adapted before being applied to entrepreneurial ventures. This implies that while technical knowledge is crucial, managerial knowledge is also essential for the success of a firm, as suggested by Bhide (2000) and Sanchez and Perez (1998).

From the above discussion, it is clear that management task is a multifaceted one. It also has a firm-specific approach. All the different dimensions of the nature of a firm's business, its stated objects, the

environment including competition, prospective trends, rapidly changing industry, market and customer behaviour, prospective threats, present and prospective changes in the product line etc. have to be taken into account while devising the management team, management tactics, and management strategy.

5.3.8 MARKETING

Marketing capabilities guide a software firm's growth and development. Not just innovation or quality/credibility helps in a firm's dynamism to development. Marketing expertise is considered to be very important for firm's market penetration. This is particularly important in a world which increasingly embraces globalization. The critical importance of marketing shall be demonstrated through an example. In the early 1980', three operating systems for personal computers existed- CP/M, DOS, and Apple Macintosh. Eventually, Microsoft's DOS became dominant, in part due to its acceptance by IBM, a major manufacturer of personal computers. DOS was not technically the best, but Microsoft became the market leader (Arthur, 1996).

Marketing is crucial in case of a nation like India. This is because majority of its software is export oriented. (John, 2004). Marketing limitations always constrain developing software for export. Large-sized firms are always placed safe in this regard on account of their huge potential for liaison building and market capture and the ready availability of funds.

Paucity of funds creates monolithic disaster to firms. Usually high cost is involved in launching a new product in a foreign market. The small software firms who are derelict end up in a complete fiasco in such situations.

Another problem noticed for developing country firms are the lack of proper activism from their foreign partners. In many a circumstance, foreign dealers/distributors are said to be reluctant in commercializing software from developing country firms.

A weak domestic market is said to be curtailing the prospects of developing software products. There is a wide gap persists between the size of the domestic software market and export market. The domestic market is not a matured and developed market (John ,2004). However, there are other non-technical factors that influence product development (Krishnan and Prabhu, 2004). Most products and applications are off-the-shelf software programs, such as word-processing, financial programs, statistical packages and the like.

The question as to why India is not good at making products has to do with the size of the domestic market (Desai, 2001), which is influenced by the installed base of hardware in the economy and its associated network extemalities.

Applications software have a more stable environment with low entry barriers since they are based on standard hardware and operating system platforms (Casper and Glimstedt, 2001). But, at the same time, user

community feed back also directs the application software. Therefore, development and expansion of the domestic market will have a favourable impact on software product development.

In a global market, collaboration with foreign players is a key for success. Strategic partnership on a macro level helps firms to utilize each other's strengths and know-how to improve their scale of innovation, quality standards and market percolation. In India, in recent years, there were signs of overseas collaboration on an increasing scale.

India's software economy is a U.S. driven economy. Most companies focus to expand their business in the U.S. This is evident from the fact that majority of the software export by India firms has been to the U.S. By destination, 68 percent of software exports went to North America, overwhelmingly to the U.S. 21 percent to Europe, 2 percent to Japan, and 10 percent to the rest of the world (Nasscom,2003). The relative undue weight age upon Europe and other parts of the world is limiting India's prospects. However, of late, Indian companies have started realizing that to follow a global delivery model; they need to spread across the globe.

The top Indian software companies have realized that to become MNCs in the true sense, they have to be literally spread throughout landscapes. It is being increasingly felt that being present in pockets in the U.S. and U.K. will not fetch the desired targets.

The concept of near shore locations has also entered the outsourcing jargons in the last few years-places in countries close to the actual market

being addressed (De,2005). The near shore centers offer two types of advantages. Primarily, it offers cost advantages over offshore locations in India. The second merit is that the benefits of geographical proximity and cultural similarity often help in business generation.

While Indian software companies have always excelled in onsite and offshore, the onus is now on near shore, primarily by means of establishing development centers and full-fledged business development offices in multiple geographies staffing them with local professionals in the client interfacing team (De, 2005). Thus, in the client interfacing, the staffing of local professionals bears a crucial role. This is a clear hint towards the changing shift in the marketing strategies of Indian software corporate houses.

The novel thinking on the lines of near shore locations is evident from the fact that today a TCS has offices in Budapest or Brasilia or Montevideo (Uruguay), Wipro in Dubai or Haninge (Sweden) and Kiel (Germany), or an Infosys in Toronto. The U.S.A. still commands the export orientation of Indian software firms. But there is predominantly a European tilt in regard to the establishing near shore location. The researcher feels that this is mainly because Europe is gradually emerging as the market destination for outsourcing.

India predominantly being a software service provider, the marketing expenditure is not analyzed to be a big factor. Selling cost is relevant largely in the case of software products. It has been noted that in the case of software products, large multinational companies dominate the market and

spend upto 60-65 percent of the price component of packages on marketing and distribution (Kumar, 2001). In recent years in India, many Small and Medium Enterprises (SMEs) have come up with a range of products and packages. However, the highly successful packages could be found out to be limited in number.

A relatively high outlay associated with the marketing shall be analyzed to be one of the culprits. However, the share of SME segment is increasing year on year. As per NASSCOM estimates 50-60 percent of software industry will be from the SME segment by 2008 (Dataquest,2005). According to Sangeetha Gupta, VP, Nasscom, "70 percent of NASSCOM's members are SMEs and marketing is their biggest pain point. It is the lack of specialization that is the biggest impediment that SMEs face". (Dataquest, 2005).

When considering the unique nature of Indian market, penetration of technology, increased pace of globalization and faster growth in the economy, the innovation as well as marketing tactics /strategy of the firms need to be re-shaped. New and innovative marketing tools are more relevant in the changing scenario (Mahajan and Wind, 1992). Marketing remains to be a crucial determinant in guiding the volume and orientation of software export of Indian corporate houses.

5.3.9 CREDIBILITY/QUALITY

Credibility and quality are the buzz words of today's industrial world. Competitiveness has become the underlying feature of sustainability today.

Quality and the resultant credibility are the sine quo non of an industry's existence and dynamism.

During the last two decades, research on quality management has been showing vibrancy. The evolution of Total Quality Management (TQM) which systemizes management practices, strategy and organizational outcomes to create a quality organization that continuously upgrades and sustains performance, has attracted the attention of top level managers in the manufacturing industry (Samson and Terziovski, 1999). During the last one decade, service industry has also started adopting TQM, having witnessed a dramatic upsurge in the level of competitiveness achieved by TQM organizations in manufacturing. Some studies have been conducted to investigate the relationship between TQM and business performance, and the relationship between quality and productivity (Huff, Fornell and Anderson 1996). Most of these studies were the attempts on quality management in manufacturing and service industries. However, relevant studies on TQM in software industry happened to be very few.

Software industry is growing exponentially all over the world. Present day firms have understood that quality and credibility are the keys to success, competitive advantage and sustainability. Many software development firms from India are obtaining quality certifications such as ISO 9000 or evaluation against the Software Engineers Institute's (SEI) Capability Maturity Model (CMM), to maintain their positions in the global market.

Quality management shall be considered to the prime mover for enhanced business performance (Corbett, Adam, Harrisons, Lee, Rho and Samson, 1998). However, in many cases, top level executives do not always back TQM unless a correlation between organizational performance and TQM is instituted (Bowles and Hammond, 1991).

Quality has a direct correlation with the success of a firm and the specialization of a country. For instance, Israel has emerged as a source of entrepreneurial firms developing software products in areas such as security and anti-virus technology. This critically explains the scenario that the said country could set quality norms in their specializations viz, security and anti-virus software, and its quality standards are empirically superior to that of other country firms.

The most popular quality certification in India is the ISO 9001 of the International Standards Organization (Radice, 1995). Paulk et al (1993) asserted that many firms hunted for quality certification process developed specifically for software viz; CMM.

CMM model is specifically designed for software and stipulated the standards in different stages of software development that a firm at a given level of maturity must have. ISO certification roughly corresponds to maturity level two in the CMM model (Arora and Arunachalam, 2000).

From a scenario which speaks that more and more firms are striving to attain quality certifications, it is clear that quality certifications and quality itself are increasingly becoming pertinent for a firm's obtaining of contracts

and its business growth strategy. While this being the case, there has been contrary resolutions by scholars which note that the correlation between quality and business performance is not as strong as in case of manufacturing industry. Madu, Kuei and Jacob (1996) opined that the correlation between quality management factors and organizational performance is not strong in service organizations. They argued that unlike a defective product, a substandard quality service cannot be replaced. Some felt that the chief focus of service quality management must be on customers (Schneider and Bowen, 1995).

Issac, Rajendran and Anantharaman (2003) have identified the following as the critical factors of quality management in software development. They are

a) Top management commitment and leadership

b) Organisational Culture (OC)

c) Customer focus

d) Process quality management

e) Quality measures or metrics

f) Human Resources Management (HRM)

g) Employee Empowerment

h) Communication

i) Continuous Improvement

j) Benchmarking (BM)

k) Infrastructure and facilities

l) Employee Attitude, and

m) Risk management

Issac, Rajedran and Anantharaman (2003) concluded their study with the following observations:

i. Quality has gained acceptance as a key factor that helps organizations to achieve success and competitive edge in the global market.

ii. The quality certified firms have better product attributes and return on quality than the non-certified firms.

iii. There appears to be no difference between non-certified firms and ISO certified firms, where as the CMM highly rated firms are better than non-certified firms and ISO certified firms.

iv. High ratings, such as CMM levels 4 or 5 help software organizations to have superior operational performance relative to ISO 9000 certification.

The researcher of this study feels that the scope of the above said study (Issac, Rajendran and Anantharaman, 2003) is limited since it has ventured only to a limited aspect of searching the differentials in merit scale of two certifications viz. ISO 9000 and CMM. It shall be argued that the elementary students of software industry, even, have well-acknowledged that CMM certifications are much superior to ISO 9000 certification.

In any case, a primary aspect of developing world class products is the establishment of effective quality systems within the product development project and across the organization. Firms like TCS and Infosys have developed specific quality systems for their customized software development projects. However, extending this quality system for their products has been a difficult task (Nambisan, 2001).

The internally developed quality system on the one hand and quality certifications from external agencies on the other hand, serve different purposes. Likewise, it is noted that quality systems for packages are to be different from such a system developed for customized services. Anyhow, quality is the prime parameter for credibility and success of a firm.

5.3.10 COST

Cost is a concept which is vehemently peculiar in case of India's software success. India is known in IT jargons as a country of cost-effectiveness. Managers buying so-called offshore outsourcing services tend to shop for the lowest cost supplier. These costs are driven by the wages of software labour from the junior programmers to the seasoned project managers (Carmel, 2003).

The differences in wage rates are striking and very tempting for IT leaders who are under cost pressures. Along with quality human resources, wage differentials are seen to be a comparative advantage which India enjoyed. However, in recent years, wages in India were bid up and India is

no longer the lowest cost software nation. Instead, many firms are turning to China, Vietnam, and others where wages may be lower (Carmel, 2003).

Till 2004, the lower cost of labour has been augmented which gave a leverage for India. But the recent literature shows that the comparative advantage which India enjoyed in low wages is getting mitigated. The vast supply of technology talents (in China) helps (it) to keep wage inflation and turnover rates at bay, while higher wage rates have cut into Indian companies' margins (The Hindu Business Line, 2005) This is termed "race to the bottom" of software exports in services. There is relatively little that nations can do to compete in this cycle in which foreign investment and interest quickly shift to lower wage nations. In the post-war period, industrial manufacturing began shifting to Japan, which then became too expensive, and then it shifted to Korea and Taiwan which then became too expensive, and then it shifted to China, Thailand and elsewhere (Carmel, 2003).

However, it is to be noted here that the qualified software professionals' supply still exceeds its demand and India may still have a call in software services. The pool of IT professionals in India is about 5,22,000 and the total demand is about 4,00,000 (Gartner, 2002). However, India is now counted only one of the destinations where cheap and abundant but inexpensive labour is available.

The Indian software industry faces a number of challenges as the labour cost advantages diminished competition from other countries with supplies of educated and under utilized workers increases (Arora and Arunachalam,2000). The prime factor behind the current comparative

advantage is the relatively low labour cost in India (Mahajan, 2000; Kumar, 2001). But, given the flexible international division of labour, the potential threat of this industry migrating to other countries, in the event of a rise in wage cost cannot be ruled out (Parthasarathy and Joseph, 2004). Therefore, a dynamism in strategy is needed by embracing innovation based on efficiency thereby replacing the current competition based on labour cost advantage.

While the cost of ICT and software manpower in India is much lower than in developed economies, it is much higher than the prevailing wage rate in other sectors in India. A study notices that the salaries of software personnel have been growing at a rate of 25-30 percent per annum (Kumar, 2001).

Some totally different aspects of cost are also to be considered. The marginal revenue of Indian software players is lower than that of her counterparts in the developed world. This is partly because a large number of the projects handled by Indian firms are low-end software services.

5.3.11 EXTERNAL FACTORS

External environment influences any system including software. Many external factors guide the growth and development of India's software industry and its export. It is almost difficult to enumerate and elaborate the influence effected by all the different external factors upon the software industry. Multilateral agreements like GATT/WTO, the pace of industrialization in economies like USA, the periods of boom/depression in

the global economy, geographical proximity to certain developed nations, immigration and labour laws of overseas governments etc shall be counted as some of such factors.

India developed a strong software industry relying on foreign demand in spite of having weak domestic demand for software (Carmel, 2003). This is an important pointer to the fact of a great emphasis the external changes have upon the software business of India.

Important determinants like US visa policy guide the fortunes of Indian players. US policy guidelines on H1 B visa is important. The H1B visa (or simply called H1 Visa) is a non-immigrant employment based visa for workers coming to the USA to perform a "speciality-occupation". Starting in the 1990s and continuing to 2001, the tremendous demand for good quality and relatively inexpensive Indian workforce saw body shoppers processing H_1B visas with practiced ease (Dataquest, 2005).

Since the Indian software export is heavily U.S. concentric, there is a dire need for Indian players to seek other markets like Europe. Increased concentration on markets other than the U.S. could be noticed these days (Dataquest, 2005).

5.3.11 CULTURAL /NON-ECONOMIC FACTORS

The factors affecting the export system of Indian software are not always necessarily economic in nature. The cultural variables are said to be having a considerable impact upon the emergence as well as the growth of

the industry. For example, the personality characteristics of people of different geographies are different.

"India is not a very assertive culture; Indians tend to go along with what other people say, especially with authority figures" (Nicholson and Sahay, 2001).

The cultural lag (Ogburn, 1964) which is created on account of the rapid growth in ICT industry in India and comparatively lower rate of simultaneous growth in non-material culture creates problems in embracing the new technologies. The consumer is a part of the society here. When cultural lag is created, considerable unhealthy environment is also created in societal outlook.

Many studies have been conducted on cultural and political issues in the information systems areas (Giddens, 1990, 1991). The work culture of Indian software professionals is said to be one of "role of discipline" (Nicholson and Sahay, 2001). The role of non-economic forces could be analyzed by many scholars. Some important facets of it can be seen in the works of Latour (1996), Wastell (1996), Baskerville, Travis and Truex (1992).

The traditional cultural setup directs the logical reasoning of human brain. For example, Nicholson and Sahay (2001) suggest that the 'traditional skilling' help Indians to be mathematically adept and disciplined in their thinking. It is to be argued that the role of non-economic and cultural factors are significant in the growth of an industry like software since this industry

is one of the most dynamic industries of the world. Shore and Venkatachalam (1995) discuss the influence of national cultural factors on the approaches to parts of the systems development life style.

Work culture in a scenario of disciplined software development environment is so crucial that it guides both the quality as well as the time frame within which the contract has to be executed and transferred back to the client organization. Hierarchical structuring is so ingrained in India that it is often easier to work in a superior-subordinate role than as equals on contractual terms (Sinha, 1988).

Cultural assimilation and cross-cultural fertilization are also the issues where the norms of the society and the expectations and ethos of people keep changing. The openness to the idea of computerization on a large scale in the economy, for example, may be the result of influence of foreign media. Western mass media bring images, symbols, products and entertainment into developing nations (Hall, 1991; Marin, 1995). The role of cultural or non-economic variables is conspicuous. However, the researcher is constrained here to discuss and elaborate each and every non-economic variable which are supposed to have a bearing on software development, innovation and software industry, since it is a Herculean task on account of time and space constraints.

Structural equation Model (SEM)

In the earlier section there had been discussed the application of univariate analysis and its various utilities across a spectrum of factors

which correlate with the software industry and export. Although it had been useful for a systematic analysis from the point of view of a confirmatory research analysis, it is perplexed with number of anomalies. It has failed to take into account nonlinearities, correlated independents, measurement error, correlated error terms, multiple latent independents each measured by multiple indicators, and one or more latent dependents also each with multiple indicators. On the other hand, SEM may be used as a more powerful alternative to multiple regression, path analysis, factor analysis, time series analysis and analysis of covariance. That is, these procedures may be seen as special cases of SEM, or to put it another way, SEM is an extension of the general linear model (GLM) of which multiple regression is a part.

SEM includes more flexible assumptions (particularly allowing interpretation even in the face of multicollinearity), use of confirmatory factor analysis to reduce measurement error by including multiple indicators per latent variable. The attraction of SEM's graphical modeling interface, the desirability of testing models overall rather than coefficients individually, the ability to test models with multiple dependents, the ability to model mediating variables, the ability to model error terms, the ability to test coefficients across multiple between – subjects groups, and ability to handle difficult data.

The SEM implies a structure for the covariance between the observed variables, which provides the alternative name covariance structure modeling (Hox and Bechger, 1995). However, the model can be

extended to include means of observed variables or factors in the model, which makes covariance structure modeling a less accurate name. Structural equation model is often visualized by a diagram. The statistical model is usually represented in a set of matrix equations. SEM is usually viewed as a confirmatory rather than exploratory procedure, using any one of the following three approaches.

1. **Strictly confirmatory approach**

A model is tested using SEM goodness-of-fit tests to determine if the pattern of variances and covariances in the data is consistent with a structural (path) model specified by the researcher.

2. **Alternative models approach**

One may test two or more causal models to determine which has the best fit. There are many goodness-of-fit measures, reflecting different considerations, and usually three or four are reported by the researcher. Although desirable in principle, this approach runs into the real world problem that in most specific research topics areas, the researcher does not find in the literature two well-developed alternative models to test.

3. **Model development approach**

In practice, much SEM research combines confirmatory and exploratory purposes: a model is tested using SEM procedures, found to be deficient, and an alternative model is then tested based on changes suggested by SEM modification indexes. This is the most common

approach found in the literature. The problem with the models confirmed in this manner are post-hoc ones which may not be stable. Researchers may attempt to overcome this problem by using a cross-validation strategy under which the model is developed using a calibration data sample and then confirmed using an independent validation sample.

Mathematically, SEM shall be represented in the following set of equations:

$$\eta = B\eta + \Gamma\xi + \zeta \quad (mX_1)$$

$$Y = A_y\eta + \varepsilon$$

$$X = A_x\xi + \delta$$

with

$$E(\xi) = 0 \qquad \text{cov}(\zeta) = \psi$$

$$E(\varepsilon) = 0 \qquad \text{cov}(\varepsilon) = \theta\varepsilon$$

$$E(\delta) = 0 \qquad \text{cov}(\delta) = \theta\varepsilon$$

Here ξ, ε are mutually uncorrelated;

$\text{Cov}(\xi) = \theta$; ξ is uncorrelated with ζ ; ε is uncorrelated with η: δ is uncorrelated with ζ; B has zeros on the diagonal; and $I - B$ is nonsingular. In addition to the above assumptions, we take $E(\zeta) = 0$ and $E(\eta) = 0$.

The qualities ζ, η in the first model are the cause-and-effect variables, respectively, and, ordinarily, are not directly observed. They are some times

called latent variables. A good discussion on SEM shall be seen in Jorskog and Sorbom (1989). The quantities Y and X are variables that are linearly related to η and ζ through the coefficient matrices *Ay* and *Ax*, and these variables can be measured. Their observed values constitute the data.

The structural equation modeling process centres around two steps: validating the measurement model and fitting the structural model. The former is accomplished primarily through path analysis with latent variables. One starts by specifying a model on the basis of theory. Each variable in the model is conceptualized as a latent one, measured by multiple indicators.

Estimation and Model Fit

In SEM, it is usually assumed that the sample data follow a multivariate normal distribution, so that means and covariance matrix contains all the information (Hox and Bechger, 1995). The method most widely used for estimation is Maximum Likelihood (MLE) estimation, which assumes multivariate normal data.

For a given set of data, researcher can suggest a large number of models. The most suitable model can be chosen by applying goodness-of-fit measures. Jaccard and Wan (1996) recommend at least 3 fit tests. Following are some of the important fit tests.

1. **Model Chi Square:-** Model Chi-square , also called discrepancy, is the most common fit test. The Chi-square value should be significant if there is a good model fit, while a significant chi-square indicates lack of satisfactory model fit.

2. **Satorra – Bentler scaled Chi-square: -** This is an adjustment to Chi-square which penalizes Chi-square for the amount of Kurtosis in the data.

3. **Goodness-of-fit Index** (GFI): - It is the percent of observed covariances explained by the covariances implied by the model. GFI deals with error in reproducing the variance-covariance matrix. GFI should be greater than or equivalent to 0.90 to accept the model.

4. **Adjusted goodness-of-fit index**, AGFI: - AGFI is a variant of GFI which uses mean squares instead of total sums of squares. AGFI should be at least 0.90

5. **Root mean square residuals, or RMS residuals, or RMSR or RMR: -**

   The closer the RMR to 0 for a model being tested, the better the model fit.

6. **Centrality Index, CI:-**

   CI is a function of model Chi-square, degrees of freedom in the model, and sample size. By convention, CI should be 0.90 or higher to accept the model.

7. **Relative non-centrality index , RNI: -**

   It penalizes for sample size as well as model complexity. It should be greater than 0.90 for good fit.

8. **Comparative Fit Index, CFI:-**

CFI compares the existing model fit with a null model which assumes the latent variables in the model are uncorrelated.

9. **Incremental Fit Index, IFI:-**

It is also known as DELTA 2. By convention, IFI should be equal to or greater than 0.90 to accept the model.

10. **Parsimony ratio (PRATIO):-**

It is the ratio of the degrees of freedom in the model to degrees of freedom in the null model.

11. **Root mean square error of approximation, RMSEA**

It is also known as RMS or RMSE or discrepancy per degree of freedom. By convention, there is good model fit if RMSEA is less than or equal to 0.05.

12. **AIC**

It is the Akaike Information Criterion. AIC is a goodness-of-fit measure which adjust model Chi-square to penalize for model complexity.

13. **BIC**

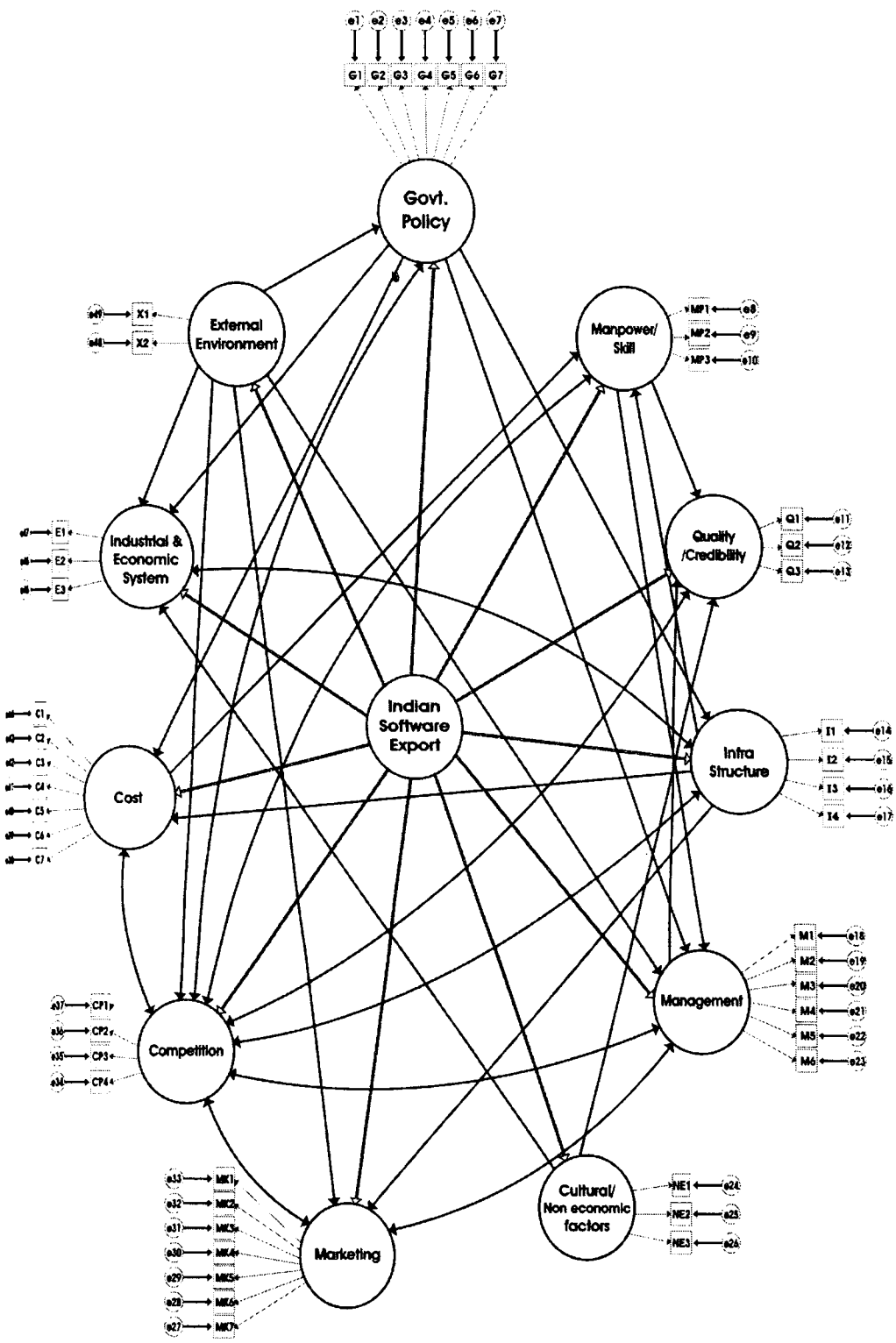
It is the Bayesian Information Criterion. It is also known as Akaike's Bayesian Information Criterion (ABIC) and the Schwarz

Bayesian Criterion (SBC). BIC penalizes for sample size as well as model complexity.

A large number other goodness of fit measures are also available. But since explaining all these are practically impossible, the researcher has taken into account only those which are considered to be the most important.

The researcher designed structural equation model (SEM) based on the data obtained from interview method and online survey. The model is drawn using the Analysis of Moment Structures (AMOS 4.0). The model is shown in figure 5.2.

Figure 5.2 STRUCTURAL EQUATION MODEL OF SOFTWARE EXPORT GUIDING FACTORS



The out put obtained from the SEM using AMOS is given in the tables 5.1, 5.2, 5.3 and 5.4

Table 5.2 VARIANCES – SEM

	Estimate	S.E.	C.R
Govt. Policy	0.592	0.097	6.087
Manpower	0.710	0.062	11.416
Quality/Credibility	0.222	0.028	8.061
Infrastructure	0.272	0.038	7.147
Management	0.299	0.027	10.993
Cultural/Non Economic	0.099	0.020	4.990
Marketing	0.157	0.016	9.817
Competition	0.965	0.055	17.429
Cost	1.000		
Industrial /Economic System	0.372	0.037	7.287
External Environment	0.610	0.063	8.416
e1	0.593	0.024	24.489
e2	0.600	0.024	24.848
e3	0.543	0.022	24.986
e4	0.465	0.019	24.712
e5	0.664	0.026	25.120
e6	0.680	0.027	25.135
e7	0.613	0.024	25.022
e8	0.668	0.026	25.283
e9	0.640	0.025	25.111
e10	0.663	0.026	25.197
e11	0.713	0.028	25.312
e12	0.736	0.029	25.468
e13	0.846	0.033	25.481
e14	0.770	0.030	25.489
e15	0.799	0.031	25.680
e16	0.716	0.028	25.565
e17	0.703	0.028	25.551
e18	0.708	0.028	25.671
e19	0.842	0.033	25.610
e20	0.938	0.036	25.774
e21	0.642	0.025	25.625
e22	0.661	0.026	25.478
e23	0.691	0.027	25.578
e24	0.975	0.038	25.909
e25	1.314	0.051	26.017
e26	0.417	0.017	24.798
e27	0.426	0.019	22.845

e28	0.398	0.017	23.850
e29	0.957	0.034	21.914
e30	0.395	0.017	23.182
e31	0.715	0.030	23.840
e32	0.858	0.044	23.924
e33	0.278	0.013	20.884
e34	0.584	0.024	23.878
e35	0.664	0.027	24.190
e36	0.411	0.016	25.044
e37	0.388	0.018	21.193
e38	0.398	0.018	21.802
e39	1.104	0.047	23.384
e40	0.744	0.057	13.144
e41	0.819	0.054	15.267
e42	0.813	0.033	24.291
e43	0.958	0.044	21.924
e44	0.673	0.039	17.360
e45	0.844	0.033	25.486
e46	1.258	0.050	25.265
e47	0.760	0.049	15.448
e48	0.985	0.045	21.676
e49	0.844	0.092	9.129

Table 5.3 COVARIANCE – SEM

	Estimate	S.E.	C.R.
Govt. Policy<----> Competition	0.183	0.033	5.490
Manpower <-----> Competition	0.068	0.017	4.124
Quality<------> Competition	0.038	0.017	2.253
Infrastructure<---> Industrial Environment	0.019	5.185	0.099
Infrastructure <----> Competition	0.095	0.009	2.571
Management <---> Competition	0.046	0.012	3.782
Management <------> Marketing	0.119	0.028	4.232
Competition <------> Marketing	0.300	0.026	11.556
Competition <-------> Cost	0.162	0.022	7.323

Table 5.4 MAXIMUM LIKELIHOOD ESTIMATES - SEM

Regression Weights:	Estimate	S.E.	C.R.
G1<-------Govt. Policy	1.000		
G2 <------Govt. Policy	1.098	0.164	6.706
G3 <------Govt. Policy	0.784	0.051	15.378
G4 <------Govt. Policy	1.155	0.059	19.549
G5 <------Govt. Policy	0.441	0.046	9.583
G6 <------Govt. Policy	0.670	0.072	9.358
G7<-------Govt. Policy	1.563	0.114	13.742
MP1<-----Man Power	1.000		
MP2<-----Man Power	1.557	0.128	12.193
MP3 <----Man Power	1.103	0.057	19.191
Q1 <------Quality	1.000		
Q2 <------Quality	1.155	0.059	19.549
Q3<------ Quality	0.616	0.043	14.371
I1 <------ Infrastructure	1.000		
I2 <------ Infrastructure	0.999	0.060	16.525
I3<------- Infrastructure	1.259	0.137	9.210
M1<------Management	1.000		
M2 <-----Management	1.430	0.152	9.394
M3 <-----Management	1.307	0.140	9.305
M4 <-----Management	1.391	0.149	9.320
M5 <-----Management	1.656	0.100	16.523
M6 <-----Management	1.379	0.080	17.186
M7 <-----Management	1.089	0.089	12.225

NE1<----Cultural /Non economic	1.000		
NE2 <---Cultural /Non economic	1.234	0.075	16.511
NE3 <---Cultural /Non economic	1.505	0.086	17.449
MK1 <---------Marketing	1.806	0.123	14.701
MK2<---------Marketing	0.647	0.035	18.537
MK3 <---------Marketing	0.636	0.031	20.664
MK4<---------Marketing	0.701	0.028	25.314
MK5 <---------Marketing	0.728	0.028	26.372
MK6 <---------Marketing	0.655	0.026	24.773
MK7 <---------Marketing	0.710	0.031	22.842
CP1 <---------Competition	1.000		
CP2 <---------Competition	0.667	0.028	24.224
CP3 <---------Competition	0.719	0.028	25.612
CP4<---------Competition	0.720	0.028	25.459
C1 <---------- Cost	1.000		
C 2<---------- Cost	0.781	0.030	26.259
C3 <---------- Cost	0.822	0.031	26.339
C4 <---------- Cost	0.772	0.029	26.472
C5 <---------- Cost	0.823	0.030	27.882
C6 <---------- Cost	0.836	0.029	28.794
C7 <---------- Cost	0.850	0.029	29.411
E1<---------- Industrial Eco System	1.000		
E2<---------- Industrial Eco System	0.758	0.030	24.949
E3<---------- Industrial Eco System	0.704	0.029	24.100
X1 <---------- External Environment	1.000		
X2 <---------- External Environment	0.807	0.029	28.121

Table: 5.5 SUMMARY OF MODELS - SEM

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	188	5842.832	1351	0.000	4.325
Saturated model			1539	0.000	0
Independence model	54	223448.185	1485	0.000	150.470

DELTA1	RHO1	DELTA2		RHO2	
Model	NFI	RFI	IFI	TLI	CFI
Default model	0.974	0.971	0.980	0.978	0.980
Saturated model	1.000	1.000		1.000	
Independence model	0.000	0.000	0.000	0.000	0.000

Model	PRATIO	PNFI	PCFI
Default model	0.910	0.886	0.891
Saturated model	0.000	0.000	0.000
Independence model	1.000	0.000	0.000

Model	NCP	LO 90	HI 90
Default model	4491.832	4258.766	4731.698
Saturated model	0.000	0.000	0.000
Independence model	221963.185	220413.863	223518.797

Model	FMIN	F0	LO 90
Default model	4.200	3.229	3.062
Saturated model	0.000	0.000	0.000
Independence model	160.639	159.571	158.457

Model	RMSEA	LO 90	HI 90
Default model	0.049	0.048	0.050
Independence model	0.328	0.327	0.329

Model	AIC	BCC	BIC
Default model	621.000	8.832	623.000
Saturated model	307.000	8.000	320.000
Independence model	223556.185	22.000	356.000

Model	ECVI	LO 90	HI 90
Default model	4.471	4.303	4.643
Saturated model	2.213	2.213	2.213
Independence model	160.716	159.602	161.835

	HOELTER	HOELTER
Model	0.05	0.01
Default model	343	352
Independence model	10	11

For the above model, it is very important to identify how adequately the model reflected the worth and range of data. Here, the Comparative Fit Index is 0.980 which confirms that the model is highly suitable. Also, Incremental Fit Index in the model is 0.980 and Parsimony ratio is 0.910. This shows that the model's acceptability is at the confirmatory level.

Root mean square error of approximation (RMSEA) is 0.0490 in the model which claims that the totality of error terms is limited and within the prescribed level.

It is also inferred from table 5.12 that Cost, Competition, Manpower, Government Policy and External Environment are having greater impact upon the software export of the country.

From Table 5.13 it is understood that Competition & Marketing, Government Policy & Competition, Competition & Cost and Management & Marketing are highly correlated. This also means that a unit changes in competition impacts 30 percent effect on marketing of software. Similarly other covariance relations shall also be explained in the SEM.

Table 5.14 discusses the maximum likelihood estimates of all the eleven factors. For instance, Single Window Facility (G7) has a significance of four times the significance of Intellectual Property Rights (G4). Likewise, the other estimates shall also be interpreted.

The designing of SEM of Software Export Guiding factors has got both theoretical as well practical advantages. The crucial point of significance of this study and model is its ability of quantifying each and

every weightage of all the different variables and factors influencing software export and its competitiveness. Also, since the objectivity criteria are maintained, the model conveys a value free approach. The policy makers including government machinery would be at advantage while using this model for future policy decisions, since the relative importance and criticality of all the factors and its variable are detailed in the model.

INDIA: POSITIONING BASED ON COMPETITIVENESS

6.1 INTRODUCTION

A major task, which lies ahead of the researcher, now, is to analyze how far the Indian software export sector is competitive and to find out the position of Indian software in the arena of global software industry. In the previous chapters, a number of important aspects pertaining to the low profile aspect of domestic sector of the software industry, comparative analysis of three emerging software nations – India, Ireland and Israel, the relative importance of various factors influencing software industry etc. have been studied. In yet another chapter, the researcher had suggested a Structural Equation Model (SEM) for software export success factors. Here, the researcher felt the need to study and compare the governing factors of software industry of other important players with that of India and make possible and formulate the positioning of the software industry based on competitiveness.

The simpler definition of competitiveness is the ability to defend and\or gain market share in open international markets by relying upon price and\or quality of goods or services. Competitiveness measurement has to take into account the competitors and the evolution of the relevant variables over time (Morgenroth, 2004). With much of its revenues derived from export earnings, with geographical concentration of its exports and changing requirements of the clients therein, it needs

to constantly work towards improving its competitiveness. Competitiveness is productivity; competitiveness is what the World Economic Forum defines as the set of institutions and policies that determine the level of productivity.

Things that matter are the macro-economic stability of a country, the soundness of institutions, market efficiency, labour market flexibility, goods market flexibility, financial market flexibility, innovation and the ability to adopt technologies that are invented somewhere else etc. So there are many factors that determine competitiveness.

The theoretical framework of this study is formulated through some near comprehensive literature scrutiny. Inclinations of some of such theories shall be understood through some definitions, which are listed below.

It is the ability of a country to achieve sustained high rates of growth in GDP per capita (World Economic Forum, 1996). National competitiveness refers to a country's ability to create, produce, distribute and/or service products in international trade while earning rising returns on its resources (Scott and Lodge, 1985).

Competitiveness is relative and not absolute. It depends on shareholder and customer values, financial strength which determines the ability to act and react within the competitive environment and the potential of people and technology in implementing the necessary strategic changes. Competitiveness can only be sustained if an

appropriate balance is maintained between these factors, which can be of conflicting nature (Feurer and Chaharbaghi, 1994).

It is the immediate and future ability of, and opportunities for, entrepreneurs to design goods worldwide whose price and non-price qualities form a more attractive package than those of foreign and domestic competitors (World Competitiveness Report, 1991). Competitiveness includes both efficiency (reaching goals at the lowest possible cost) and effectiveness (having the right goals). It is this choice of industrial goals which is crucial. Competitiveness includes both the ends and the means towards those ends (Buckley, 1988).

Competitiveness implies elements of productivity, efficiency and profitability. But it is not an end in itself or a target. It is a powerful means to achieve rising living standards and increasing social welfare - a tool for achieving targets. Globally, by increasing productivity and efficiency in the context of international specialization, competitiveness provides the basis for raising peoples' earnings in a non-inflationary way (Ciampi Group, 1995). It implies supporting the ability of companies, industries, regions, nations or supranational regions to generate, while being and remaining exposed to international competition, relatively high factor income and factor employment levels (OECD, 1996).

Thus, even though competitiveness is understood in different dimensions, some variables are understood to be the underlying measures of competitiveness. In this way, competitiveness is the capability of a company or country to cope up with the dynamic changes

in an industry in terms of innovation, skill, business environment, infrastructure etc. and thereby edge out its competitors. It is considered to be the innovation, which is the key for this competitiveness of a company/nation. The innovation shall be either endogenous or exogenous. The research & development (R&D) personnel, capacity for scientific innovation of a company etc. are the endogenous factors of a software business firm. The key indices such as business environment, infrastructure etc shall be termed exogenous on account of the fact that the critical determinants of these provisions are to be sponsored by agencies like the government. Competitiveness helps corporate houses understand and compare the factors that make countries attractive as the present or potential locations for software business. Wage structure of a country, total work force, tax structure, magnitude and quality of infrastructure and infrastructure costs, attrition rate, security of IPR and so on influence the degree of competitiveness of a nation.

Competitiveness is primarily based on comparative advantage which a nation enjoys in specific fields of talents / skill, cost differentials etc. India's export competitiveness is said to be on account of its comparative advantage of skilled technological manpower. India's comparative advantage in knowledge based new economy is making its presence felt; more so when North American economy is service oriented where nearly two thirds of its employment and output are linked to services (Bhachech, 2005). This is on account of the fact that the export competitiveness of Indian software sector is primarily guided by

the demand of American corporate firms and its dynamism towards future.

One school of thought argues that low cost of labour in India is its primary index of competitive advantage. But others argue that low wages are not a competitive tool. General equilibrium analysis says that low wages in India is not an instrument of competitive advantage; instead, they are a consequence of the productivity differential (Kling, 2004). Even the low costs in India are offset by high costs of coordination, communication and control of multiple sites (Narula, 1999; Mariani, 1999).

6.2 METHODOLOGY

Various scholars in measuring the competitive advantage of software developing nations have undertaken different studies. However it is understood that many of these studies were not able to exactly ascertain the comparative positioning of different software states. Among the available tools used by different studies, AT Kearney Attractiveness Index is taken for the purpose of identifying the prospective software locations and offshore destinations as well as to measure the complexities involved in business operations in different nations with an IT background or prospects (Dataquest, 2005)

The researcher has opted to take AT Kearney competitiveness Index and its components as the source of this study. The secondary data available at this study has been chosen on account of (a) this

index is widely taken by scholars as an acceptable and reliable index. (b) the index has included an array of factors\determinants in measuring the competitiveness. (c) the index took into consideration almost all the major players of the market.

One major drawback that could be noticed was that the study while, framing out, has concentrated on the business interests of a single nation. Therefore, the study has got an element of bias. It is to be noted that the researcher has taken all the 12 measurements of A.T. Kearney index, for the purpose of this work. The 12 measurements have been categorized into 3 major groups. The details are given in the table 6.1:

Table 6.1 A.T. KEARNEY – VARIABLES OF ATTRACTIVE INDEX

CATEGORY	SUB-CATEGORIES	METRICS
Financial Structure	Compensation costs	Average wages. Median compensation costs for relevant positions (such as call center representatives, IT programmers and local operations managers)
	Infrastructure costs	Includes occupancy, electricity and telecommunications systems. Travel to major customer destinations
	Tax and regulatory costs	Relative tax burden, costs of corruption and fluctuating exchange rates
People Skills And Availability	Cumulative business process experience and skills	Existing IT and BPO market size Contact center and IT-quality rankings. Quality rankings of management and IT training.

	Labor force availability	Total workforce. University-educated workforce
	Education and language	Scores on standardized education and language tests.
	Attrition rates	Relative BPO growth and unemployment rates.
Business Environment	Country infrastructure	Investor and analyst rating of overall business and political environment. A.T. Kearney's Foreign Direct Investment Confidence Index Extent of bureaucracy. Government support for the information and communications technology (ICT) sector.
	Cultural adaptability	Blended metric of infrastructure quality (telecommunications, IT services).
	Cultural adaptability	Personal interaction score from A.T. Kearney's Globalization Index.
	Security of intellectual property (IP)	Investor ratings of IP protection and ICT Laws. Software piracy rates.

Source: **A.T. Kearney**

A.T. Kearney research group has adopted various scales for creating offshore location attractiveness index. The variables taken by the research group have been adopted directly for this work also. This is on account of the fact that the variables behind the competitiveness index are the same as that of the 'offshore location attractiveness index'.

The need for this study was felt when the researcher has gone through AT Kearney Offshore Location Attractiveness Index (2004). This is on account of two reasons:

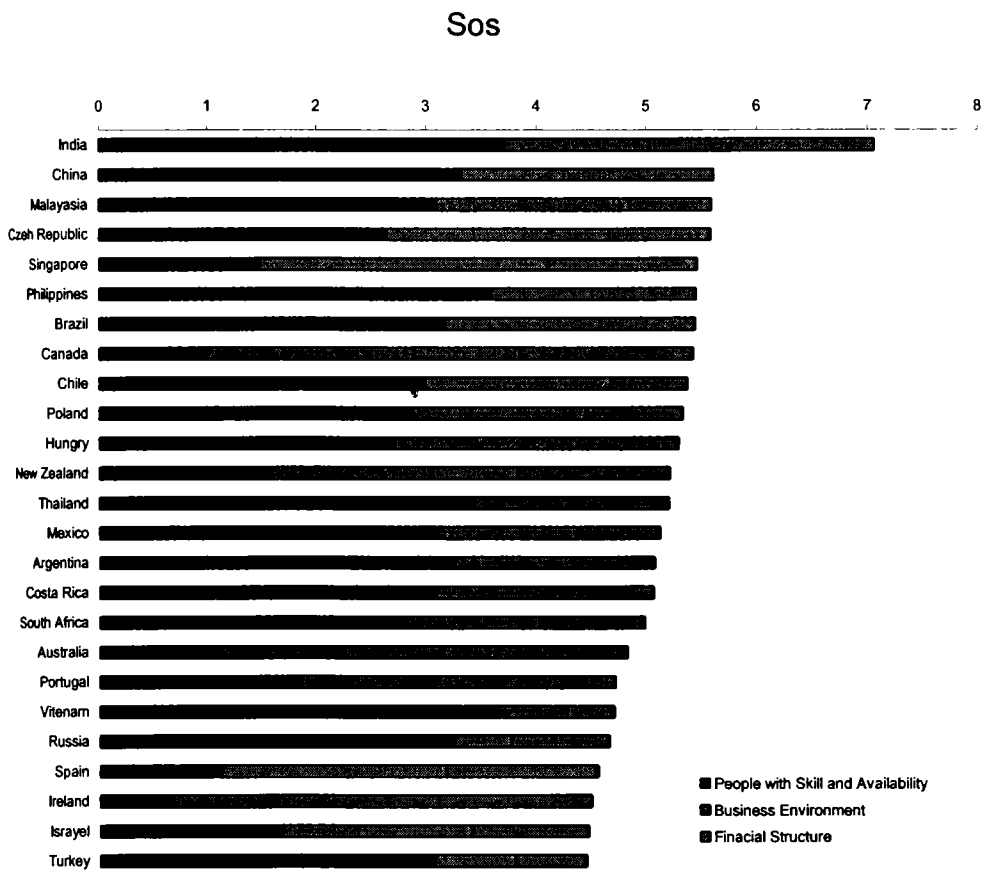
The said index categorized 12 variables into 3 groups (Financial Structure, People skills and Availability and Business environment). These 3 categories were given specific weightage in the said index, viz; 40 percent to financial structure and 30 percentage each to people skills and availability and business environment. The researcher felt a dire need for the modification of this index on account of:

1. The criteria chosen by the research group for the ratio of 40:30:30 is subjective and it does not bear a value free approach.

2. All the variables are mostly economic variables. These variables are highly correlated. But in the said study the correlation aspect has not at all been taken into account. Subsequently, the problem of multi-collinearity also has not been solved. It is well recognized that while framing statistical studies, the problem of multi-collinearity has to be well addressed. (Belsky et.al ,1980).

The figure 6.1 is the AT Kearney 2004 off shore location attractiveness index. From this figure, it is clearly understood that India is ranked No. 1 ahead of countries like China, Canada, Australia, Ireland and Israel.

Figure 6.1 A.T. KEARNEY OFFSHORE LOCATION ATTRACTIVENESS



Source: **A.T. Kearney**

It is suggested here therefore, that the Principal Component Analysis (PCA) method will be suitable in the case of this study. PCA is a multi-variate statistical tool commonly used to reduce the dimensions of a multi-variate data. Here the researcher tries to extract the maximum of information out of the data available. PCA enables the researcher to compute a compact and optimal description of the data set. Under PCA, a set of correlated variables is transformed into a set of uncorrelated variables, which are ordered by reducing variability.

Principal Component Analysis is widely used in economics, business management, marketing management etc. It is also known as Karhunen_ Loeve transform.

The utility of the principal component methodology lies in its ability to reduce the dimensionality of data to describe the movement of many variables in terms of a small number of independent underlying patterns that can often be interpreted in terms of simple heuristics. This can be useful in a variety of contests, and principal components have been employed as a data reduction technique for "untangling complex patterns of association in multivariate data" (Green, 1978). Development and discussion of this technique can be found in Green (1978) and Johnson and Wichhern (1982). The application of PCA could be seen in the area of multi product pricing also (Depken and Grant).

The basic idea of PCA is to find the components $S_1, S_2..S_n$ so that they explain the maximum amount of variance possible by n linearly transformed component say, $W_1,\ldots\ldots$ Wn.

$$W_1 = \arg \max_{\|W\|=1} E(W^T X)^2$$

Where W1 is of the same dimension as in the random data vector X. In general, the K-th principal component is determined by the formula

$$W_K = \arg \max_{\|W\|=1} E[W^T (X - \sum_{i=1}^{k-1} w_i w_i^T x])^2$$

6.3 IDENTIFICATION OF PRINCIPAL COMPONENTS AND RANKING.

In this section, PCA is applied to the variables of competitiveness listed in table 6.1. It is pointed out in section 6.2 that correlation exists among the available variables. The researcher has taken proper precautionary measures for avoiding redundancy and thereby maximizes the accuracy of the results. The Table 6.2 manifests the degree of redundancy among exogenous (independent) variables:

Table 6.2 CORRELATIONS OF INDEPENDENT VARIABLES.

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12
X1	1.0000	0.2575	0.4272	0.4133	0.0186	0.3555	0.4813	0.2173	0.3551	-0.3852	-0.0805	0.1414
X2	0.2575	1.0000	0.0958	-0.3654	-0.3235	-0.3690	-0.4826	-0.4723	-0.5499	0.4724	0.0886	-0.1124
X3	0.4272	0.0958	1.0000	0.5816	-0.2790	0.4934	0.3806	0.4601	0.3205	-0.4507	-0.0376	-0.0165
X4	0.4133	-0.3654	0.5816	1.0000	0.1499	0.5877	0.6145	0.4859	0.5888	-0.6966	-0.1995	0.3535
X5	0.0186	-0.3235	-0.2790	0.1499	1.0000	0.0512	0.4683	0.3386	0.4726	-0.4603	0.1070	0.1073
X6	0.3555	-0.3690	0.4934	0.5877	0.0512	1.0000	0.6129	0.7094	0.7285	-0.6377	-0.0926	0.3163
X7	0.4813	-0.4826	0.3806	0.6145	0.4683	0.6129	1.0000	0.6856	0.8523	-0.8144	0.0441	0.2804
X8	0.2173	-0.4723	0.4601	0.4859	0.3386	0.7094	0.6856	1.0000	0.8173	-0.8095	0.1502	0.2089
X9	0.3551	-0.5499	0.3205	0.5888	0.4726	0.7285	0.8523	0.8173	1.0000	-0.8542	-0.0547	0.3333
X10	-0.3852	0.4724	-0.4507	-0.6966	-0.4603	-0.6377	-0.8144	-0.8095	-0.8542	1.0000	-0.0128	-0.2808
X11	-0.0805	0.0886	-0.0376	-0.1995	0.1070	-0.0926	0.0441	0.1502	-0.0547	-0.0128	1.0000	0.0944
X12	0.1414	-0.1124	-0.0165	0.3535	0.1073	0.3163	0.2804	0.2089	0.3333	-0.2808	0.0944	1.0000

Where,

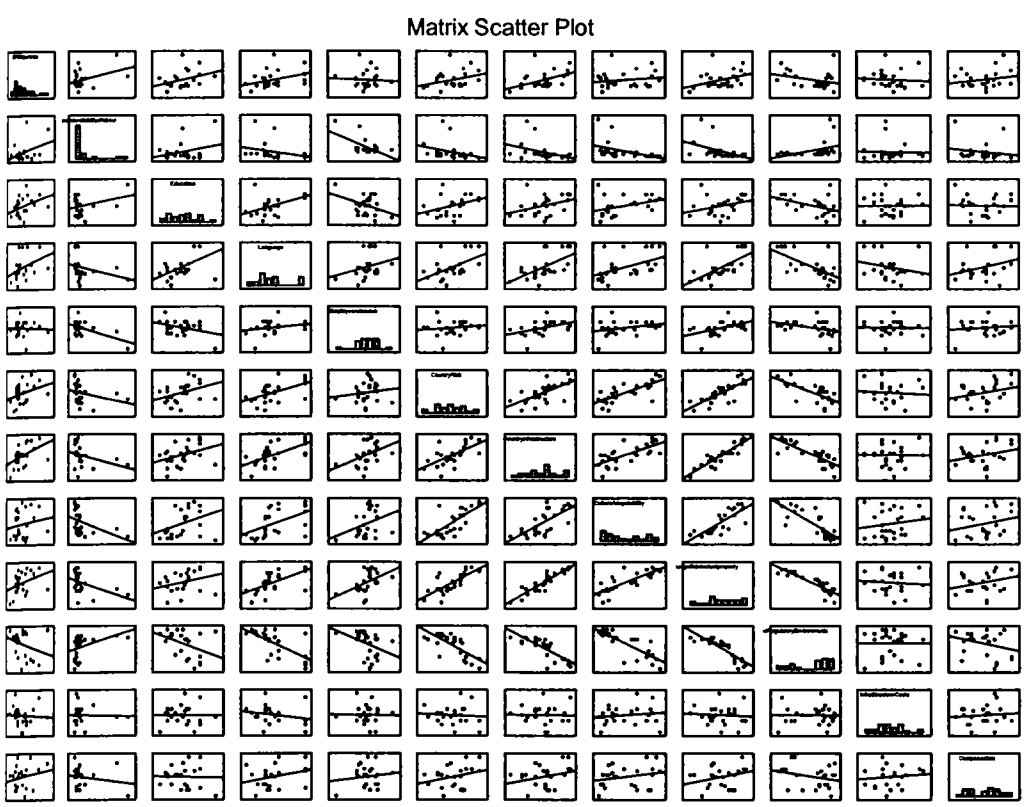
X1 - BPO Experience

X2 - Size and Availability of labor

X3 - Education
X4 - Language
X5 - Employee Retention
X6 - Country Risk
X7 - Country Infrastructure
X8 - Culture Adaptability
X9 - Security of Intellectual Property
X10 - Tax and Regulatory Environment
X11 - Infrastructure costs; and
X12 - Compensation

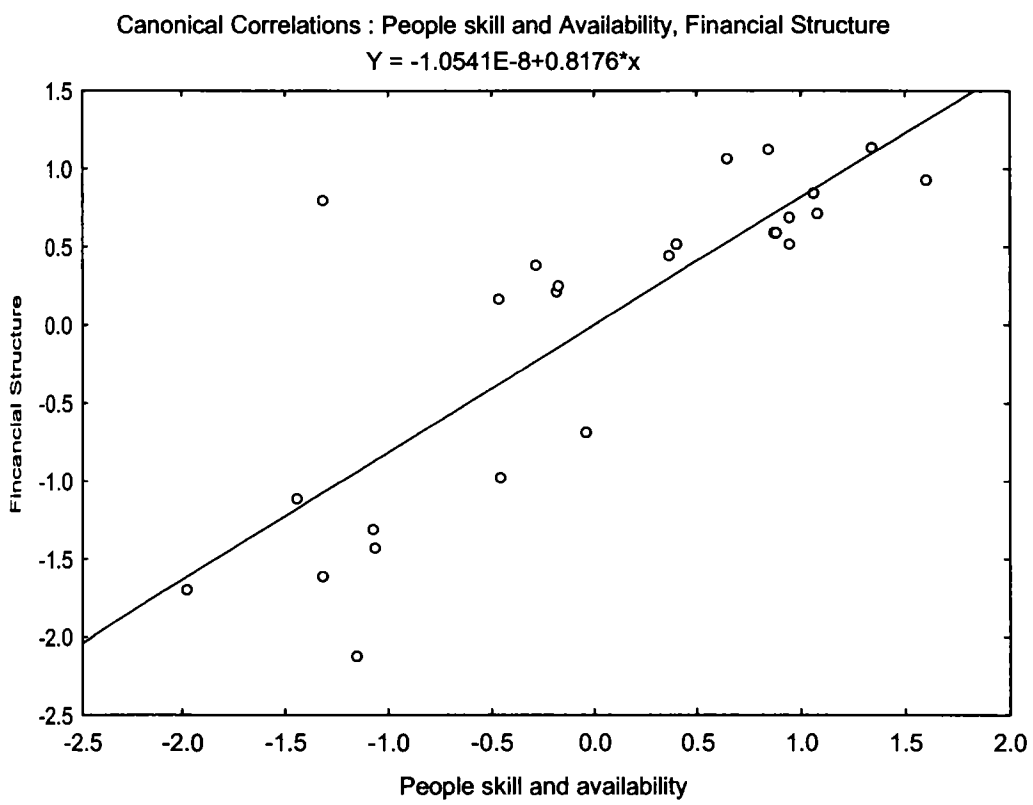
The high level of redundancy is conspicuous from the matrix scatter plot figure 6.2.

Figure 6.2: MATRIX SCATTER PLOT OF SELECTED VARIABLES



The existence of high degree multi-collinearity can also be evinced through the demonstration of another multivariate statistical tool viz., Canonical Correlation (Johnson and Wichhern, 2002). The figure 6.3 shows the canonical correlation, which is existed among the variables of financial structure and people skill and availability.

Figure 6.3 – CANONICAL CORRELATIONS: VARIABLES OF FINANCIAL STRUCTURE AND PEOPLE SKILL AND AVAILABILITY.



The relationship between people skill and availability and financial structure can be modeled as:

$$Y = -1.0541E\text{-}8+0.8176\ X$$

Where,

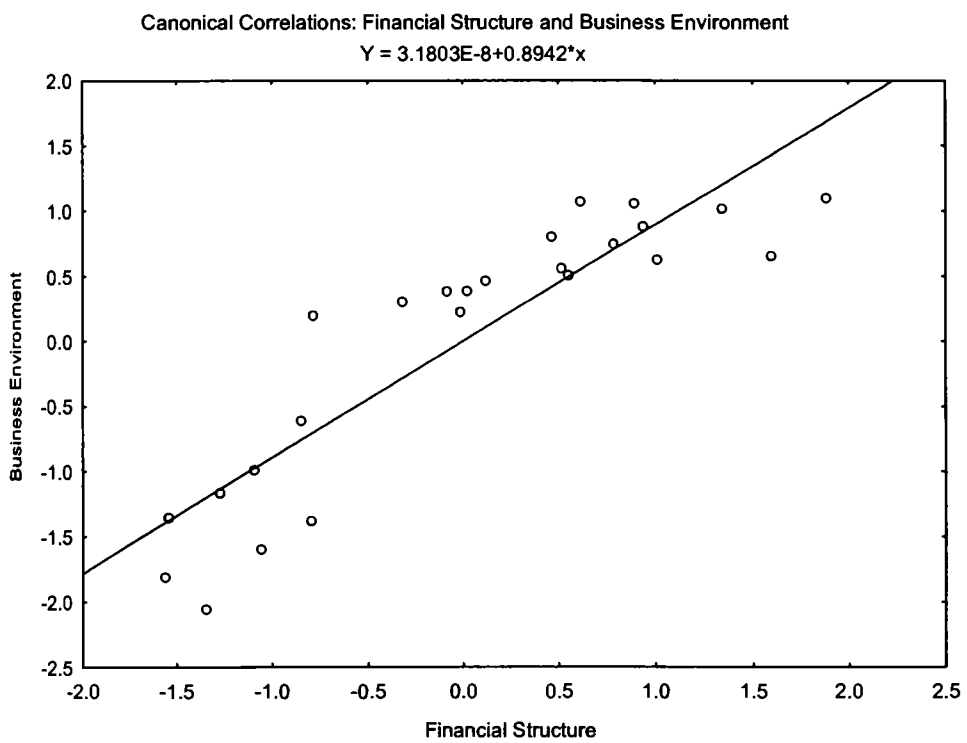
Y = Financial structure, and

X = People skill and availability

The above model suggests that one unit change in people skill and availability will induce a positive change of 0.8176 in financial structure. One can establish the said relation in also the other way around.

Similarly, the Figure 6.4 suggests the canonical correlation among the variables of business environment and financial structure.

Figure 6.4 CANONICAL CORRELATION AMONG VARIABLES OF BUSINESS ENVIRONMENT AND FINANCIAL STRUCTURE.



The relationship between business environment and financial structure can be summarized as:

Y = 3.1803 E-8 + 0.8942 X

Where

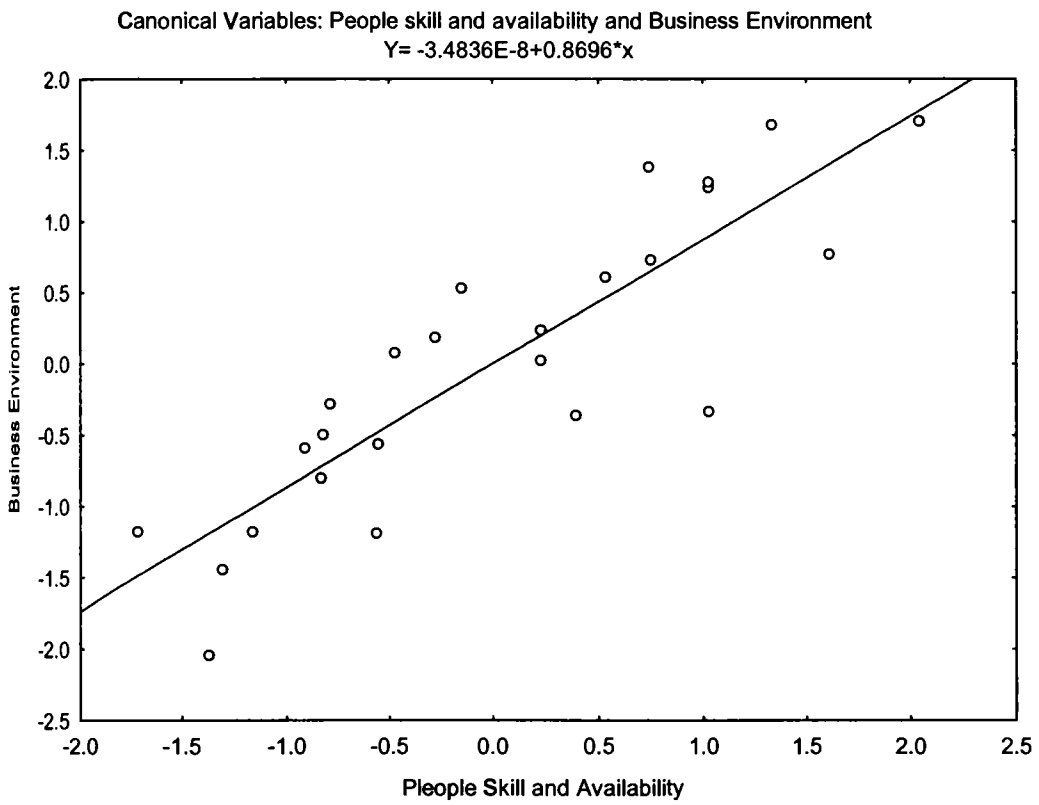
Y = Business Environment; and

X = Financial Structure

One unit change in financial structure can influence 0.89-unit change in business environment and also the other way around.

One can also model such a correlation among the variables of business environment and people skill and availability.

Figure 6.5 – CANONICAL CORRELATION AMONG THE VARIABLES OF BUSINESS ENVIRONMENT AND PEOPLE SKILL AND AVAILABILITY.



Here, Business Environment and People Skill and Availability shall be related through the equation.

$Y = -3.4836\ E - 8 + 0.8696\ X$

Where,

Y = Business Environment; and

X = People skill and availability.

The above model suggests that one unit improvement in people skill and availability will induce a change of 0.8696 in business environment and vice versa.

It is understood that high correlation is conspicuous between certain variables. For instance, the security of intellectual property and country risk has a correlation of 0.728. As well there is a negative correlation of 0.814 between country infrastructure and tax and regulatory environment. Therefore, the variables discussed are highly multi-collinear.

It is very imperative to point out here that the variables under consideration were dependent and correlated both pair wise as well as group wise. Since it could be observed that there exists a kind of correlation, some innate drawbacks could be attributed in AT Kearney Index.

The researcher identified two principle components W1 and W2.

$$W_1 = 0.453X_1 - 0.523X_2 + 0.512X_3 + 0.773X_4 + 0.0398X_5 + 0.80X_6 + 0.895X_7 + 0.852X_8 + 0931X_9 - 0.928X_{10} - 0.027X_{11} + 0.371X_{12}.$$

H_2 = 0.575 X_1 +0.577X_2+0.704X_3+0.263X_4-0.666X_5+0.194X_6-0.087X_7 0.108X_8-0.17X_9+0.072X_{10}-0.221X_{11}-0.068X_{12}.

The above facts can be summarized in the component-loading table 6.3:

Table 6.3- COMPONENT LOADINGS

Components	Dimension	
	1	2
BPO Experience	0.4534	0.5753
Size and availability of labor	-0.5230	0.5773
Education	0.5124	0.7040
Language	0.7730	0.2631
Employee Retention	0.3981	-0.6661
Country Risk	0.8001	0.1945
Country Infrastructure	0.8948	-0.0868
Culture Adaptability	0.8517	-0.1077
Security of Intellectual property	0.9307	-0.1705
Tax and Regulatory Environments	-0.9277	0.0716
Infrastructure Costs	-0.0275	-0.2214
Compensation	0.3710	-0.0677

The potency of two principal components shall be found out from the table 6.4.

Eigen value points to the magnitude of the variance extracted by the principal components. The first principal component variable was able to extirpate 71.016 percent of variance and the second principal component was able to wrench out 18.056 percent of variance in the original data.

When clubbing both the principal components together it could be able to distillate 89.071 percent of the total information.

Table 6.4 – VARIANCE EXPLAINED BY PCA.

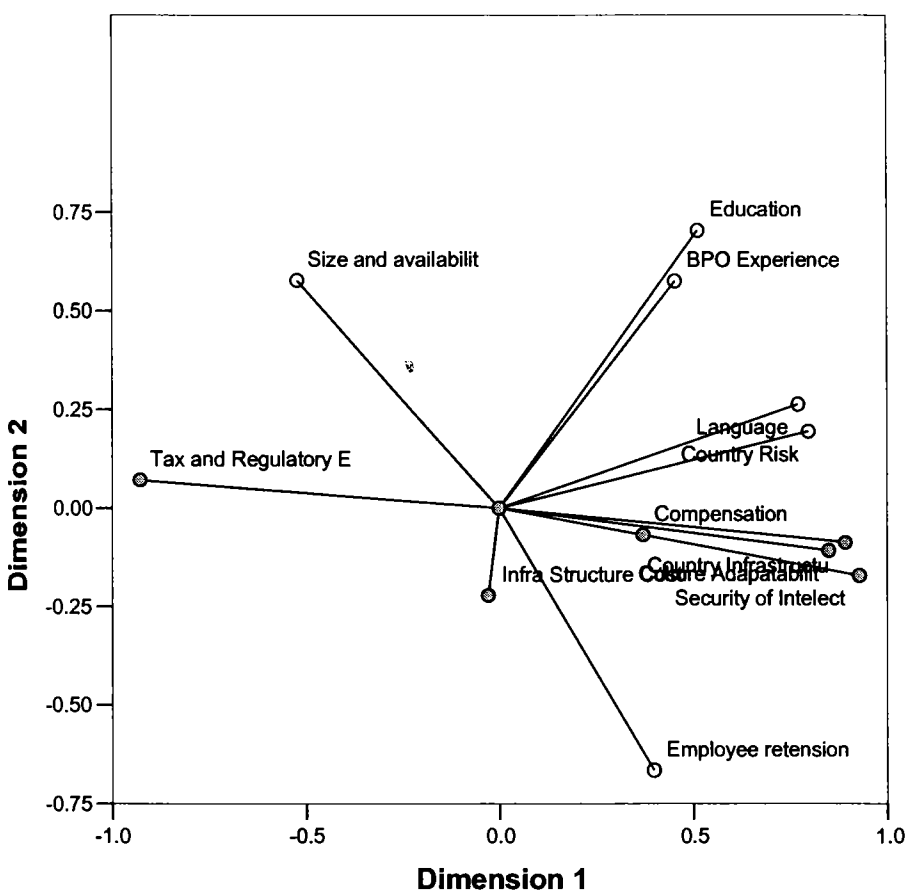
Dimension	Cronbach's Alpha	Variance Accounted	
		Total (Eigen value)	% of Variance
1	.864	2.841	71.016
2	-.513	.722	18.056
Total	.959(a)	3.563	89.071

In this work, if the correlation could have been ignored, it would have violated all the important theoretical assumptions. A.T. Kearney Attractiveness index had omitted this aspect of correlation. The degree of reliability therefore cannot be ascertained. In contrast, in the PCA method applied in this study, the inference is reliable to the extent of almost 90 percent.

It is analysed that security of intellectual property is very important in deciding the attractiveness of an off- shore location A.T. Kearney Index also opines the same inference. The component loading shall be graphically represented as shown in Figure 6.6.

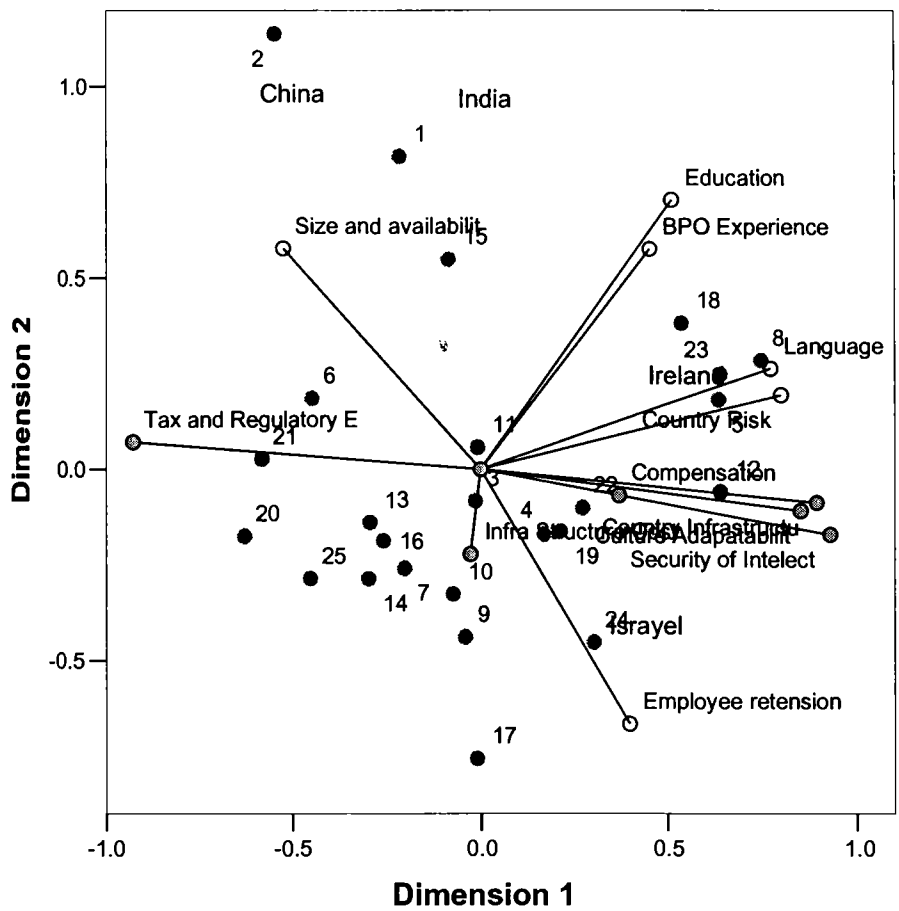
Likewise, tax and regulatory settings is having very crucial impact upon the attractiveness. However, the relationship between the two is antithetical since the component loading is negative.

Figure 6.6 COMPONENT LOADING GRAPH



It is discerned that the labour arbitration has got an interesting perspective. When size and availability of labour expands, the retention rate shrinks. This is very evident in case of India, where the availability of labour is huge whereas the employee retention rate is low. It is also found that the cost of infrastructure is comparatively insignificant in deciding the competitiveness. In order to find out the attractiveness of each country in terms of different criteria used, the researcher ventured for a Biplot. It is shown in Figure 6.7 :

Figure 6.7 BIPLOT SHOWING FACTORES



From the biplot, it is interpreted that size and availability of skilled labour is the most initial attraction for India and China. Education, BPO experience etc are the elements, which give credit to India, and India is benefiting heavily out of its large pool of educated manpower.

The objects scores are calculated from W1 and W2 for each country and they are given in the table no. 6.5. The 25 nations are grouped into five categories and the relative objects scores are plotted in the figure 6.8.

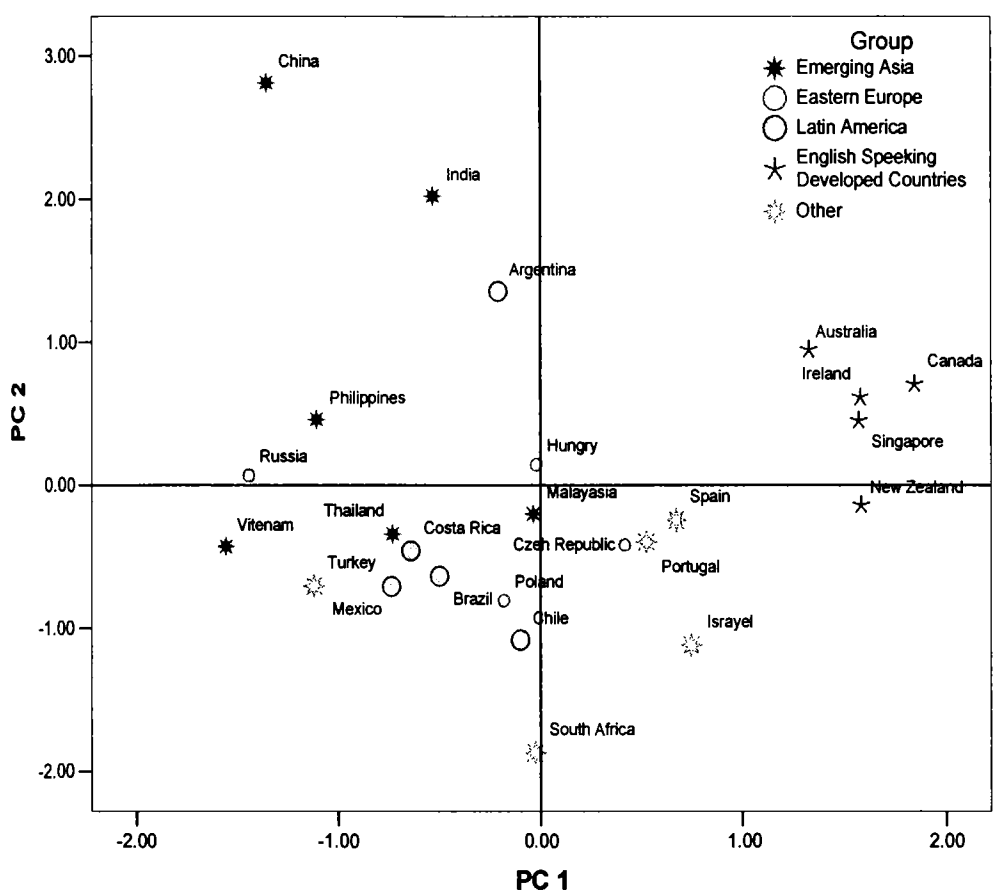
Table 6.5: OBJECTS SCORES BASED ON FIRST TWO PRINCIPAL COMPONENTS.

Country	People with Skill and Availability	Business Environment	Financial Structure	W1	W2
India	3.72	1.31	2.03	-0.48	1.04
China	3.32	0.93	1.36	-1.57	4.35
Malaysia	3.09	1.77	0.73	-0.09	-0.43
Czech Republic	2.64	2.02	0.92	0.33	-0.43
Singapore	1.47	2.63	1.36	1.63	0.44
Philippines	3.59	0.92	0.94	-0.88	-0.13
Brazil	3.17	1.41	0.86	-0.26	-0.21
Canada	1.00	2.48	1.94	1.75	0.31
Chile	2.99	1.68	0.70	-0.14	-0.31
Poland	2.88	1.57	0.88	-0.28	-0.52
Hungry	2.71	1.68	0.90	0.04	-0.21
New Zealand	1.59	2.24	1.38	1.51	0.19
Thailand	3.44	1.19	0.57	-1.02	-0.58
Mexico	3.12	1.26	0.74	-0.74	-0.59
Argentina	3.25	1.08	0.74	-0.36	0.04
Costa Rica	3.06	1.33	0.67	-0.82	-0.64
South Africa	2.83	1.21	0.94	-0.35	-0.54
Australia	1.11	2.13	1.58	1.51	0.57
Portugal	1.84	1.99	0.88	0.60	-0.47
Vietnam	3.65	0.70	0.35	-1.46	-0.95
Russia	3.25	0.51	0.89	-1.06	-0.79
Spain	1.12	2.05	1.38	0.82	0.18
Ireland	0.62	2.48	1.39	1.56	0.30
Israel	1.66	1.74	1.06	0.79	-0.14
Turkey	3.07	0.73	0.64	-1.03	-0.48

Both India and China excel in terms of different variables especially the large pool of skilled labour. The English speaking developed countries form a special cluster and they are having almost similar specifications. These nations follow similar patterns as regards infrastructure, security of

intellectual property, culture adaptability and country risk. The trend conveys a model of homogeneity - applied to the developed nations. It is to be understood that none of these countries have got something special to boast off, which the most other countries does not have, in terms of competencies. But they are superb in terms of the state-of-the-art technology and infrastructure. This means that these countries have lesser comparative advantage in software industry in factors like people skill and availability in relation to other countries, as pointed in the AT Kearney Index.

Figure 6.8: SCATTER DIAGRAM SHOWING OBJECTS SCORES OF COUNTRIES IN 5 SETS.



It is already seen that competitiveness is the extent to which a company/country coping up with dynamic changes in terms of innovation, skill, business environment, infrastructure etc. The AT Kearney Offshore Location Attractiveness Index 2004 suggested that India remained the star performer. It reiterated that India captured the top slot due to its strong mix of low costs and significant depth in human resources etc. But at the same time, this study reveals that India lags far behind many other nations with regard to infrastructure, security of intellectual property, tax and regulatory environment, affordability and so on. The fact that India is trailing behind her counterparts in determinants like infrastructure, acted as the stumbling block for her to race to the top slot in competitiveness index prepared in this chapter by the researcher.

6.4 TRAILING POSITION OF INDIA

Much literature in academic and business spectrum as well as the contemporary hype in ICT boasts that India is the 'software superpower'. A. T. Kearney index also gave India the top position. However, this study by the researcher gives a totally different picture. The table 6.6 is prepared by analyzing the objects score derived from this study.

Table 6.6: COMPETITIVENESS RANKING BASED ON PRINCIPAL COMPONENT ANALYSIS

Country	Score	Rank
India	-15.33	12
China	-32.89	17
Malaysia	-13.87	11
Czech Republic	15.84	9
Singapore	123.40	2
Philippines	-65.08	20
Brazil	-22.45	14
Canada	129.91	1
Chile	-15.59	13
Poland	-29.00	16
Hungry	-0.53	10
New Zealand	110.96	5
Thailand	-83.33	23
Mexico	-63.33	19
Argentina	-24.62	15
Costa Rica	-69.95	21
South Africa	-34.45	18
Australia	117.82	3
Portugal	34.31	8
Vietnam	-121.05	25
Russia	-89.75	24
Spain	61.12	6
Ireland	116.10	4
Israel	53.72	7
Turkey	-81.96	22

From the table 6.6, it is very much understood that India lies in the middle position ie 12th. Even though India is counted dominant in people skill and availability, B.P.O experience, education etc., this country is trailing much behind other nations like Canada, Singapore, Australia, Ireland etc, mainly because of its inadequate state of infrastructure, low employee retention etc.

The comparative scaling and relationship among world nations in many other popular ratings also suggest that India is not a front-runner in many criteria. One such index is the piracy rate.

Table6.7: SOFTWARE PIRACY

Country	1994	2002	Decline
UAE	86	36	50
Israel	78	37	37
Slovenia	96	59	37
Guatemala	94	61	33
Ireland	74	42	32
Turkey	90	58	32
Ecuador	90	59	31
Japan	66	35	31
Hungary	76	45	31
Spain	77	47	30
South Africa	64	34	30
India	79	70	9
China	99	92	7

Source: **Dataquest**

From the table 6.7, we shall interpret that over a period of 7 years, the rate of reduction in piracy happened to be extremely nominal for both India and China. On the other hand, Israel has shown a declining rate 37 and Ireland 32 in piracy rates. This points to the inadequate state of business environment and supporting systems.

Ireland remains at the top position. Generally, the English speaking developed nations are rated high above the countries like India and China. It is observed that the relative advantages they have at their stake in business environment and financial structure help them in a true sense of outpacing other nations in software development and industry.

Why India trails behind? The comparative score India obtained in business environment and infrastructure is very low. As well, the credentials of India as regards financial structure are also not so attractive.

The Network Readiness Index (NRI) developed by the World Economic Forum and the Digital Access Index (DAI) developed by the International Telecommunication Union shall be taken as another point of ratification for this antithesis.

Table 6.8: NETWORK READINESS RANKINGS

Country	Rank	
	2003-04	2003-03
USA	1	2
Singapore	2	3
Finland	3	1
Sweden	4	4
Denmark	5	8
Canada	6	6
Switzerland	7	13
Norway	8	17
Australia	9	15
Iceland	10	5
India	45	37
China	51	43

Source: **World Economic Forum**

Table6.9: ENVIRONMENT COMPONENT INDEX

Market Environment		Political & Regulatory Environment		Infrastructure Environment	
Country	Rank	Country	Rank	Country	Rank
Singapore	1	Finland	1	Iceland	1
USA	2	Hong Kong	2	USA	2
Finland	3	Estonia	3	Switzerland	3
Ireland	4	Iceland	4	Canada	4
Israel	5	Singapore	5	Singapore	5
Taiwan	6	Switzerland	6	Australia	6
Japan	7	Denmark	7	Norway	7
Luxembourg	8	USA	8	New Zealand	8
Sweden	9	UK	9	Korea	9
Switzerland	10	Luxembourg	10	Taiwan	10
India	27	India	29	India	67
China	44	China	68	China	72

Source: **World Economic Forum**

Table 6.10: READINESS COMPONENT INDEX

Individual Readiness		Business Readiness		Government Readiness	
Country	Rank	Country	Rank	Country	Rank
Norway	1	Finland	1	Singapore	1
Sweden	2	Sweden	2	Finland	2
Denmark	3	USA	3	USA	3
Finland	4	Singapore	4	France	4
USA	5	Switzerland	5	Canada	5
Australia	6	Japan	6	Malaysia	6
UK	7	Denmark	7	Denmark	7
Iceland	8	Norway	8	Germany	8
Canada	9	Germany	9	Korea	9
Switzerland	10	Canada	10	UK	10
India	80	India	47	India	31
China	62	China	59	China	47

Source: **World Economic Forum**

India lags behind many other economies in terms of Network Readiness. The NRI(Network Readiness Index) seeks to better comprehend the impact of Information and Communication Technology (ICT) on the competitiveness of nations. The NRI released by the Worlds Economic Forum in collaboration with the World Bank and INSEAD, France positions India at the 45th position in 2003-04, out of 176 world nations (Data Quest, 2004). The NRI is a composite of three components: the environment for ICT offered by a given country or community, the readiness of the community's key stakeholders (individuals, business and government) to use ICT, and finally the usage of ICT amongst these stakeholders.

Like the Network Readiness Index, the DAI tries to distinguish itself from other indices by including a number of new variables, such as education and affordability. They have classified nations into four categories.

a. High-Access Economies (Index is 0.7 and above)
b. Upper-Access Economies (0.5 to 0.69)
c. Middle-Access Economies (0.3 to 0.49)
d. Low-Access Economies (0.29 and below)

Both India and China comes in the category of Middle- Access Economies. The DAI given to India is 0.32 where as that of China is 0.43. The biggest barrier to higher levels of digital access in this group is the shortage of infrastructure (Dataquest, 2004).

Table 6.11 DIGITAL ACCESS INDEX

High-Access	DAI	Upper-Access	DAI	Middle-Access	DAI	Low-Access	DAI
Sweden	0.85	Ireland	0.69	Belarus	0.49	Zimbabwe	0.29
Denmark	0.83	Cyprus	0.68	Lebanon	0.48	Honduras	0.29
Iceland	0.82	Estonia	0.67	Thailand	0.48	Syria	0.28
Korea	0.82	Spain	0.67	Turkey	0.48	Papua New Guinea	0.26
Norway	0.79	Malta	0.67	Panama	0.47	Vanuatu	0.24
Netherlands	0.79	Czech Republic	0.66	Venezuela	0.47	Pakistan	0.24
Hong Kong	0.79	Greece	0.66	Belize	0.47	Azerbaijan	0.24
Finland	0.79	Portugal	0.65	St. Vincent	0.46	S. Tome & Principe	0.23
Taiwan	0.79	UAE	0.64	China	0.43	Tajikistan	0.21
Canada	0.78	Macao	0.64	India	0.32	Equatorial Guinea	0.2

Source: Data Quest

From the above discussion it is clear that India's position is neither up to mark nor attractive. These indices point to the urgent need for India to develop all her basic infrastructural foundations and amenities including the infrastructure for ICT industry, on a rapid scale. In the Digital Access Index, India is at the extreme bottom position of even the middle-access economies.

A detailed and microscopic view upon the already discussed indices including the index developed by the researcher in this study suggests a scenario where the competitiveness scale of India is much disgusting, except in one index i.e. AT Kearney Index. There lies much scope for improvement for India in her infrastructure and business environment status. The extremely substandard state of infrastructure and other support mechanisms could offset India's reputed credentials in her large pool of skilled manpower. One major reason for India getting No. 1 slot in AT Kearney Index was on account of the undue weightage given to one factor (i.e. people skill and availability). Rather the scientific apportioning of weightage given to various variables instead of three factors, in this study put India in the middle portion of the ladder.

SUMMARY AND CONCLUSIONS

Indians are presumably proud of the IT and ITES (Information Technology Enabled Services) industry which has virtually changed the way the world looks at India and how Indians look at themselves. The venture, which has been carried out here by the researcher, was basically an inquiry into the evidence behind this euphoria. The economic scrutiny in search of this evidence has been primarily finding out the extent to which, the Indian software industry is competitive. In this journey, the researcher studied and analyzed a large number of books on software industry and IT, articles, theses and other literature.

Studying the nature of the Indian software industry has been the primary task this study aimed at. Some notable findings have been put into limelight. The size of Indian market for its own software is a small one. Over the years the share of domestic market in total software revenue has been declining. Different econometric models have been applied over both the domestic software revenue and the export revenue. The exponential model has been found to be the most suitable one. Compound model, power model, S model, Growth model, Logistics and Exponential model were all having almost same values of model adequacy. However, the exponential model suits best for the cause primarily because of three reasons. Firstly, the trajectory of software industry in India can best be explained in terms of an exponential growth pattern. Secondly, the said model is one, which is widely accepted by the discipline of economics. The third reason is the

uniqueness of interpretation. This model has taken into consideration 99.5 percent of all the variations in the software export domain and 98.3 percent in the arena of domestic software revenue.

It is also found that the gap on exponential growth pattern between export and domestic revenue will get widened over the years to ensue. From the study, it is also established that there is a need for leveraging the domestic market. In the absence of a booming domestic market, Indian skills and labour will continue to be taken away by the overseas firms and markets.

Structural alterations of the economy in line with the efficiency, profitability and productivity are advocated. Likewise, a slew of protection measures are desired in order to safeguard Intellectual Property Rights (IPRs). The export competitiveness of software industry in the light of the performance of domestic software revenue has been analyzed.

A separate chapter has been dedicated for the comparative study of India, Israel and Ireland. These three countries are catching up with the advanced world in software innovation and industry. All the three are cited as the success cases of 1990s.When dealing with this comparative study, two kinds of econometric investigations have been carried out. The first kind of econometric investigation aimed at constructing a feasible economic model and the second one aimed at analyzing the export performance of India, Israel and Ireland in combination, on lines of panel auto regression. In case of Israel, it is understood that some major aberration could be observed in the exponential growth pattern. The year 2001, 2002 and 2003

have witnessed either no growth or negative growth. Under the exponential model, the R square value for Irish exports estimated at 0.988. The CAGR for Ireland is only 0.171. There is a clear inference that even though Ireland is the leader among the three, India could aptly be called 'the leader-prospect'. The CAGR of India was the highest among the three and it was nearly double the value of Ireland. Israel and Ireland were successful because all benefited from a strong national emphasis on advanced technical education that dates back at least one or two generations. Strong human capital in software cannot emerge within a few years.

Although they are leaders in software technology, their specialization and domain of expertise are different. For example, Ireland has specialized in the services projects, and into niche product markets, while Israel specialized in software products, especially in data commutations and information security. On the other hand, India has been specializing in customized service software and its export.

By taking into account the software export figures of India, Israel and Ireland, two models have been developed – both a fixed effects model and a random effects model.

The fixed effects model for India is constructed as

$$Y_t = 0.963219Y_{t-1} + 0.5929 + e_1$$

The fixed effects model for Israel is

$$Y_t = 0.963219Y_{t-1} + 0.4921 + e_2$$

The Irish fixed effects software export model is,

$$Y_t = 0.963219Y_{t-1} + 0.4729 + e_3$$

The R square value is 0.9978, which is significantly high. Also, since Durbin Watson Statistics is 1.78, the serial correlation in the error terms, is virtually absent.

The fixed effects model suggests that the export of the next fiscal depends up to 96.32 % of the export of the current fiscal for all the three nations. Even in this case, the fixed effect coefficient is different for all the three countries, which implies the prospective variation in the future exports of the 3 specialized nations. But it is found that the fixed effect coefficient is more favorable in case of Indian export. The built up and implicit software skill and proficiency testifies that Indian industry (when constructed this model) will contribute more for its future export growth, when compared to that of both Israel and Ireland.

The alternatively tested model is the random effects model

The random effects model for India has been

$$Y_t = 0.608626 + 0.951265Y_t - 1 + 0.0542 + e_1$$

In the same way, the random effect model for Israel is

$$Y_t = 0.608626 + 0.951265Y_{t-1} - 0.0299 + e_2$$

The same for Ireland is constructed as

$$Y_t = 0.608626 + 0.951265Y_{t-1} - .0265 + e_3$$

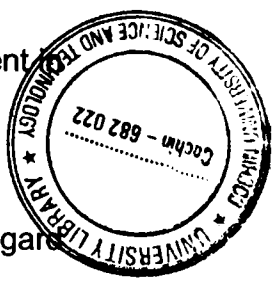
In this case, the model adequacy is 98.93 percent. The Durbin-Watson Statistics indicates the absence of serial correlation.

The above models interpret that the export of the next fiscal depends up to 95.12 percent of the export of the current fiscal, for all the 3 nations. The random effect for India is a positive one i.e., 0.056 while Israel and Ireland capabilities are negative. The prospective capability in mature software exporting of India is a unique one since this country alone has a positive random coefficient among the 3I's. Thus, higher export competitiveness is evident in case of India when the historic export figures had been applied for scrutiny.

The investigator attempted to find out a comprehensive solution by way of finding out Indian software export determining factors through a primary survey, which encompasses the responses of competent personnel from IT industry. The major determining factors such as Government Policy, Management, Cost, Quality, Competition, External Environment, Manpower, Infrastructure, Industrial and Economic system and its growth Marketing and Non-economic/ cultural variables have been taken into consideration.

Size of software firms has been taken as a scale for measuring the influence of governing factors of software industry and export. Industry response has been measured in terms of variance in order to find out the extent of impact of each of the factors upon the different sized firms. A multi-dimensional scaling diagram was moulded employing fourteen major factors there by understanding the relative loadings of each of these factors.

IT industry experts from big firms were not found to have a concrete opinion as regards the impact of government policy initiatives upon the growth of the industry.. On the contrary, medium and small-size firms believe that the state machinery can play a dynamic role in creating a competitive environment. The small firms agree more in this regard when compared to the medium firms. It is also found that the three kinds of firms have different viewpoints regarding the role and dynamism of government facilitation/ regulation.



Although they are having different dimensions of opinion with regard to Legal and Commercial System in India, they are of the opinion that legal and commercial system in India promotes rather than demotes the cause of software firms.

IPR regime is a crucial factor, which determines the development of innovation, new start-ups and flow of capital. Existing accounts prove that there is a high rate of piracy prevalent in India .On the question of whether a system of weak IPR regime hampers the interests of software firms in India, big and medium firms replied positively. But the small firms expressed the opinion that their prospects are not ruined by IPR regime in India. The researcher deduces that this difference emerged due to the small firms' concentration on services rather than products. This reason is complemented by another fact that piracy is mainly affecting the products of well-established firms. It is understood that the opinions differ significantly.

Indian entrepreneurs express their concern that getting the nod and licence of different departments of the government for a new start up are a

cumbersome and time consuming process. Therefore, a single window facility should be facilitated to provide the relevant information as well as assistance regarding various procedures to be compiled with. When opinion of the respondents were sought whether the absence of single window facility curtail the prospects of entrepreneurial activity in India, all the three groups consented that such an infrastructural and policy loopholes curtail the prospects for setting up and expansion. The opinions expressed in this regard by the three groups are on similar lines.

Strong management capability is a pointer to software process capability. The strength and competency in management shall be considered to be the backbone of software firms and industry. On the question of whether firms are run mostly by technicians who are deficient of proper management skills, the response has been affirmative. Small firms overwhelmingly supported the statement. The extent and degree of support has decelerated from small to big firms.

On the question of Organization Culture (OC) in India's cyber world, all the three kinds of firms responded against the intent of the query. All have disagreed that the OC hampers the prospect of software innovations and export. It is found out from the analysis of variance that the OC in software industry in India is conducive to its development, as against the anticipated notion of outdated organization culture. It is also understood that the opinions are of similar kind.

Big IT firms as well as medium IT firms opine that the state-the-art technology is well- established and sophisticated in India. Since this

technology is not a backward one, this does not hamper the growth of software industry. On the other hand, the small firms responded positively that the inefficient adoption of technology is a crucial factor, which obstructs the development of IT. It is analyzed from the 'F' test that all the three kinds of opinions differ significantly.

The competitive advantage in cost acts as a supportive mechanism for India's success in the export of software. India is a country, which is known for cost effectiveness in the IT industry. But with the phenomenal growth in the sector over the decades, the wage gap between Indian software professionals and their counterparts in the developed nations has started to shrink. Nevertheless, cost advantage remains substantial even today.

The constraints of venture capital create a lot of initial hurdles when starting up a software firm. Since the success of a new firm depends on a number of externalities, the financial organizations rarely come forward to put their money into the investing in a new software startup.

In the research analyses, all the three kinds of firms are found to agree that the absence of venture capital and seed money pulls back entrepreneurs from entering the business on a massive scale. Nevertheless, the small firms have increasingly felt for a mechanism of availing ready venture capital.

Similarly all have unanimously agreed that a low wage structure compliments India's comparative advantage in software development and

export. However, it is to be noted that the comparative advantage of a competitive cost structure has been diminishing because, a number of developing economies have started to train their young manpower into the software expertise

A strong commercial software technology and the continuity in climbing the value chain help firms to attract overseas business. Big, medium and small firms confirmed that the speedy delivery of services adds to the credibility of Indian companies and the quality certifications like CMM help them to pick pocket overseas money. The ANOVA test revealed that the size should not be treated to be a factor guiding quality since the responses did not vary significantly.

The extent and degree of competition has been increasing in IT sector. The Indian firms increasingly face competition from firms of Ireland, East European nations and those developing nations which are striving their level best to gain their own place in the map of global software technology and business.

All kinds of firms unanimously asserted that their foreign counter parts pose severe competition. It became conspicuous that the competition between the firms of the same country (in this case, India) reduces their prospects as well as profitability. This results in a sort of unhealthy competition, which reduces the margins of Indian companies.

It is validated that although the competition posed by countries like Ireland, Israel etc. is not something neglible, there has been no evidence

that a substantial degree of competition is prevailed. It is found that these 3 major players were not competitors among themselves. When analyzed the causative rationalities, the researcher could find that the targeted specializations and areas where the three nations are oriented were almost different and varied. While India has been a major exporter of services, Ireland and Israel have been concentrating on high-end services as well as products and packages. Israel is world - renowned in security related packages.

Globalization has ushered in a new era where the notion of self-reliance has become a myth and changes in one part of the globe create consequent ripples in other parts as well. The macro economic growth and ever increasing industrial activities in the U.S. created opportunities for Indian software firms. Outsourcing has become the order of the day. It could be established that the policy interventions of overseas nations like visa policy diminish the interests of software players.

The tremendous scientific and technological resource base is cited as the prime input behind India's software success. It has been argued by many scholars that in India, software talent is plentiful but experienced engineers and managers are deficient in number. Project management expertise is said to be scarce in India. It is inferred from the study that experienced talents in India are deficient in number.

A large reserve of English speaking manpower has been considered a national asset and a real point of attraction. The different kinds of firms

consider alike that the pool of such a reserve contributes to their success and the fortunes of the country.

Infrastructure in India is in serious doldrums. Of the many supportive mechanisms entrepreneurs require, infrastructure is considered to be one of the most critical. Big and medium players claimed that substandard telecommunications infrastructure and poor transmission quality curtail the growth prospects of ICT (Information and Communication Technology). But the conformity level has been a little marginal in case of small firms. It is understood that although poor infrastructure is a cause of concern for all, it retards the prospects of big and medium firms more.

The role of Software Technology Parks (STPs) is analyzed to be a crucial one and that the small firms have increasingly felt the need for such STPs. It is believed to be due to the fact that small firms resort more to the provisions of infrastructure made by other institutions, especially, the State. It shall be specified that a firm's size matters when it comes to the infrastructure space. A poor state of infrastructure is frequently cited as a reason which constraints the vast potential of Indian IT firms in delivering a global model.

The total industrial and economic system and its growth are highly critical in determining the growth prospects of software industry. Thus, in tandem with the mercurial rise in economic and industrial activities, the prospects of software development multiplies. But the verified result brings a different picture. The statistical analysis brought a reasoning that the firms of all different size consider that the role of the overall economic and

industrial structure in the development of software industry is a small one. This is analyzed to be due to the low scale percolation of software applications in the domestic economy. However, small firms find an emerging role of economic and industrial system, compared to the other two groups. Consequently the opinions differed substantially.

Complexity and expansion in industrial activity necessitate software application. The pace of industrialization in other nations promotes the prospects of Indian software industry and its export. All claimed that the rapid pace of external industrial activity and its growth help the Indian players in accelerating their export. The test of significance proved that the three different groups have got the similar viewpoints.

All the three groups also confirmed that the low profile electronics and hardware sector retards the prospects of software on a massive scale. Some policies, for example, the quantitative restrictions on imports of hardware and software during the early years, reduced initial prospects for growth in the software industry. And, the similarity in opinions reflects that the size of an IT firm does not matter when analyzing its outlook on the scale of havoc wreaked by a low-profile domestic electronics and hardware industry upon the software industry and its exports.

Branding is comparatively immaterial in case of India since this is mainly a service provider. Still, liaison building and marketing are considered crucial for software firms' export growth. Even though there was many an initial hassle, Indian players' international marketing expertise is claimed to be efficient and substantial. The major reason that China lags

behind India might be due to a lack of marketing acumen. But the Chinese local product branding is said to be strong. Statistical analysis proved that a small domestic market hampers innovation and software export of India. All the firms were of the similar opinion.

Also, it is analyzed from the survey results that the big firms have had sufficient degree of access to the export market. On the contrary, medium and small firms face some bottlenecks on overseas marketing front. This shows that both medium and small firms face a number of marketing hazards in selling their products/services abroad. The test of significance revealed that the opinions diverge considerably.

The participants from the survey supported the argument that the IT firms in India are vehemently U.S. –centric and place Europe in the backyard and this is a constraint, which adversely affects its growth and export prospects. Small and medium firms supported the view overtly that overemphasis on the American market limits the scope of Indian players. The test of significance proved that the three groups are of different opinions.

Non-economic variables influence how the people of a nation think like to a great extent. Non-economic and/or cultural determinants guide the way the development of software is made into effect. Empirical evidence by some theses points that cultural issues can "make or break an offshore project". It is argued by many that there is a 'programming mindset', specially 'made in India'. In the subsequent analysis, it could be established that no discrepancy was conspicuous for any group of firms in affirming that

India had an innate aptitude towards logical thinking and programming. Many old-fashioned political and religious doctrines adversely affected computerization and software development in Indian economy, as observed in the study. The test of significance pointed to the fact that all the groups were having the similar viewpoints regarding this.

The researcher has also studied various models constructed by various authorities, which were basically created to suit the guiding factors of the software export of a country. The researcher has understood the need and necessity of the creation of a new model only when going through these models. A new model called "Software Export Guiding Factors Model" could be constructed in this study. But, the theoretical criticism done on the said models are an important constituent of this study.

Michael Porter's model of competition advantages of nations, even though it was a nascent attempt, had tried to find out the crucial factors that lead into success in software exporting. But it was found out that the study was more of a general nature than a specific one . Also the model did not delimit the scope to the export spectrum alone. Rather, it had been artificially moulded to suit to a national industry's resolve to achieve global leadership over an extended period of time.

The criteria identification by Garry in his effort to construct a model in World Bank report found success in categorizing software-exporting nations. The major drawback of this study is found to be its lack of a systematic approach. Though important factors were highlighted, the whole at one

hand and the synergic interaction of these four factors on the other hand were ignored

The High Tech Indicators Model had succeeded in depicting socio-economic factors. The study has taken the subject in a macro approach. Both the cultural as well as structural factors could be taken into account in this model. But it is worth mentioning that the underlying approach adopted in the study was abstract rather than concrete.

The Software Export Success Model by Heeks and Nicholson shall be considered to be the most comprehensive model. Software exporting success of a number of new software exporting locations could be employed when building this model. The authors developed the model from success factors of India, Ireland and Israel, the success stories of 1990's.The model envisages almost all the important factors leading to software export success. As well, the study scripts the need and necessity of the production of high-end services as well as the need for innovative products and packages in order to be a global leader. But it has not spelt in detail how a transition is to be made possible from the exporter of low-end services to the one of high-end software products, packages and services. Also, this model cannot aptly be emulated in case of 3rd and 4th tier software exporting nations

The "Oval Model" fit by Carmel emphasized on eight important factors like government vision and policy, infrastructure etc. But the industrial and economic system and its growth and its resultant 'cascading effect' were neither envisioned nor considered in any of these models

including the 'Oval Model'. The change and growth in one sector of either the national economy or the overseas economy will have its ripple effects on other sectors as well, including the software. This aspect, which is one of the most relevant factors influencing software industry and export, is almost comprehensively ignored by these studies. Almost all these works have tried to explore the effect produced by various factors on the total export output of software. They could clearly identify many prime attributes of cause. However, none of these studies could either measure or quantify the marginal effect of one variable over the other or the combined effect or interactions of different variables and factors upon the whole.

It is inferred from the SEM study that Cost , Competition , Manpower, Government Policy and External Environment are having greater impact upon the software export of the country.

It is also found out that Competition & Marketing, Government Policy & Competition, Competition & Cost and Management & Marketing are highly correlated. For instance, a unit changes in competition impacts 30 percent effect on marketing of software. Similarly other covariance relations are explained in the SEM.

The maximum likelihood estimates of all the eleven factors were found out. For instance, Single Window Facility (G7) has a significance of four times the significance of Intellectual Property Rights (G4).

The designing of SEM of Software Export Guiding factors has got both theoretical as well practical advantages. The crucial point of

significance of this study and model is its ability of quantifying each and every weightage of all the different variables and factors influencing software export and its competitiveness. Also, since the objectivity criteria are maintained, the model conveys a value free approach. The policy makers including government machinery would be at advantage while using this model for future policy decisions, since the relative importance and criticality of all the factors and its variable are detailed in the model.

Another major task, which was counted to be the basic motive of the study itself, was to analyze how far the Indian software export sector is competitive and to find out the position of Indian software in the arena of global software industry. It is understood that many of the studies were not able to exactly ascertain the comparative positioning of different software states. Among the available tools used by different studies, AT Kearney Attractiveness Index is taken for the purpose of identifying the location index of prospective software nations.

It is to be noted that the researcher here, has taken into effect all the 12 measurements of A.T. Kearney index, for the scope of this work. The need for this study was felt when the researcher has gone through AT Kearney Offshore Location Attractiveness Index (2004). It categorized 12 variables into 3 groups (Financial Structure, People skills and Availability and Business environment). The researcher felt a dire need for the modification of this index on account of two reasons. Firstly, the criteria chosen by the research group for the ratio of 40:30:30 is subjective and it does not bear a value free approach. Secondly, even though the economic

variables are highly correlated, this correlation aspect has not at all been taken into account. Subsequently, the problem of multi-collinearity also has not been solved.

The researcher identified two principle components W1 and W2.

$$W_1 = 0.453X_1 - 0.523X_2 + 0.512X_3 + 0.773X_4 + 0.0398X_5 + 0.80X_6 + 0.895X_7 + 0.852X_8 + 0931X_9 - 0.928X_{10} - 0.027X_{11} + 0.371X_{12}$$

$$W_2 = 0.575\ X_1 + 0.577X_2 + 0.704X_3 + 0.263X_4 - 0.666X_5 + 0.194X_6 - 0.087X_7\ 0.108X_8 - 0.17X_9 + 0.072X_{10} - 0.221X_{11} - 0.068X_{12}$$

The first principle component variable was able to extirpate 71.016 percent of variance and the second principle component was able to wrench out 18.056 percent of variance in the original data. When both the principle components were clubbed together it has been able to distillate 89.071 percent of the total information. The AT Kearney offshore Location Attractiveness Index 2004 suggested that India remained the star performer. It reiterated that India captured the top slot due to its strong mix of low costs and significant depth in human resources etc. But the researcher in this thesis work claims that India lags far behind many other nations with regard to infrastructure, security of intellectual property, tax and regulatory environment, affordability and so on. The fact that India is trailing behind her counterparts in determinants like infrastructure, acted as the stumbling block for her to race to the top slot in competitiveness index prepared in this study by the researcher. Having applied principal component analysis, it is found out that India has been positioned 12^{th}, i.e. in the middle position of the

ladder. Even though India is considered superior in terms of people skill and availability, BPO experience etc., this country is trailing behind other nations like Canada, Singapore and Australia mainly because of its inadequate state of infrastructure, low employee retention etc. The relative positions of India's counterparts in other popular ratings confirmed that the researcher's claim with regard to India's positioning and competitiveness rating in this study is true and empirical.

The comparative score India obtained in business environment and infrastructure is very low. Similarly, India's credentials as regards financial structure are also neither beckoning nor attractive

This shows that the fractured state of infrastructure and other support mechanisms could offset India's reputed credentials of a concrete reserve of skilled manpower. The major reason for India getting No. 1 slot in AT Kearney Index was on account of the undue weight age given to one factor (i.e. people skill and availability). In this study, the researcher did scientific apportioning of weight age for different variables of competitiveness. This caused the slippage of India's positioning from top to the middle position of the competitiveness and/ or attractiveness ladder.

The first hypothesis of this study has been that the difference in turnover growth between the domestic software sales and software export is more or less constant. From the study it is found that the difference in rate of growth in turnover between domestic sales and export is not constant. So this hypothesis is rejected.

The hypothesis that the export competitiveness of software industry in India is not governed by any specific factor \ factors is rejected on the ground that this study could ascertain specific governing factors.

Since both fixed effects co-efficient and random effects co-efficient are more favourable for India than Israel and Ireland, the hypothesis that they follow similar pattern in their export turnover and competitiveness is rejected.

The hypothesis that the guiding variables of software industry in India and its competitiveness are independent irrespective of size \ turnover of software firms is rejected. ANOVA tests show that there are both independent and dependent variables. Since there is presence of dependent variables, hypothesis is rejected.

The hypothesis that the governing criteria, which guide the software export and its competitiveness, are independent in nature is rejected. Structural Equation Modeling (SEM) proves that there are interconnections and a factor of dependence.

In terms of competitiveness, India's position in global software industry domain is neither lucrative nor lukewarm is the last hypothesis which has been set. From the Principal Component Analysis (PCA) method, it was found that India's position is approximately a middle one. So the hypothesis is accepted.

SUGGESTIONS

The comparative study of India, Israel and Ireland suggests that India should specialize in products and packages and high-end services, rather than concentrating on customized services alone.

The policy makers and the government machinery have to give more importance to the development of domestic hardware and electronics industry than the factors such as the upgrading of legal system etc.

Since Information and Communications Technology (ICT) is one of the most dynamic technologies, in order to sustain the observed rate of growth in exports it is imperative that the industry moves up the value chain and progressively increases domestic development with a focus not only on software products but also on systems.

The Indian state should vigorously pursue its role of expanding and modernizing transport and telecommunications especially the level of connectivity and better bandwidth and the state-of-the-art technologies.

The competitiveness ranking of leading nations of the world suggests that in order to advance towards better competitiveness standards, policy makers should concentrate on the creation and betterment of infrastructure foundations rather than anything else.

It is also important that all-out efforts should be made to perpetuate and sustain India's relative advantage in low cost skilled manpower.

SEM study suggests that the factors such as competition, cost aspects, the impact of external environment, government policy and manpower aspects are more critical when compared to factors like management aspects, cultural system, quality parameters etc. Policy makers should take into account this aspect also.

Indian computer software industry and export garnered tremendous potential for its growth as a software super power. Export revenue double in nearly three years. But this is not a time for complacency. The measures to improve competitiveness like shifting to high- end products and services, expanding the domestic software space, removing the structural bottlenecks, maintaining the leadership in skills etc are imperative for the advancement in India's software innovation, industry and export.

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