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# **Explaining the success of the Indian IT industry**

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## **Abstract**

Specialisation in production in a specific sector by a country is often a result of the possibility of trade and an exploitation of the country's comparative advantages. The patterns of specialisation can be explained through the economic theories of either Hechscher-Ohlin and the relative endowment of production factors, or Ricardo with differences in production technologies. To additionally promote specialization in a sector, comparative advantages can be created through directed industrial policies and strengthened by foreign direct investments. The ability to exploit comparative advantages and export goods depends on the demand from foreign markets which could increase through the creation of a reputation.

Factors important for the development of an IT industry in India are analysed in this study in order to give an explanation for India's specialisation in the IT sector. The comparative advantage of high skilled labour at a low cost and the liberalisation of the economy, which shifted the development strategy from import substitution to export orientation, often explain the development of the IT industry. However this study indicates that there are more factors which have contributed significantly to a specialisation in IT, and these are knowledge of English, industry policies directed towards the sector, foreign direct investment and a creation of a reputation in the global market.

Key words: IT industry, India, comparative advantages, industry policies, foreign direct investment.

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## Abbreviations

BPO	Business Process Outsourcing
CMM	Capability Maturity Model
DoE	Department of Electronics
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GE	General Electric
IIT	Indian Institute of Technology
IMF	International Monetary Fund
IT	Information Technology
ITES	Information Technology Enabled Services
KPO	Knowledge Process Outsourcing
MNC	Multinational Corporation
NASSCOM	National Association of Software and Service Companies
NPE	National Policy of Education
SEI	Software Engineering Institute
STPI	Software Technology Parks India
TCS	Tata Consulting Services
TI	Texas Instrument

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# 1 Introduction

If countries exploit their comparative advantage in production and trade, there can be specialisation in the production of goods in a specific sector, though the specialization does not need to be complete. There are several economic theories which analyse comparative advantage and patterns of specialisation. Hechscher-Olin explains a comparative advantage in production through comparing a country's relatively endowment of production factors in the economy within and across countries. A country will produce goods using the abundant factor most intensively in production, which can lead to specialisation in a specific sector. Ricardo explains comparative advantage as different technologies among countries, where specialisation for a developing country occurs in a sector in which it has similar technology to a developed country. According to Rodrik specialisation patterns can be strengthened by creating and implementing industry policies which are directed towards the production of a specific sector. The presence of foreign investors can also increase the specialisation patterns.

The Indian IT industry has had a successful development during the last 20 years and has an annual growth today of around 40 per cent. The turnover of the IT industry increased from US dollar 2.0 billion in 1994 to US dollar 12.2 billion in 2000, implying that it has become more than six times bigger, while the total Indian GDP during the same time only doubled. The growing IT industry indicates a specialisation in IT products and services in the Indian economy which have been promoted by the government through policies directed towards the sector. The sector is mostly export driven, with a focus on the US and European markets. The IT industry consists of both hardware and software products and services, but the latter has been more significant for the growth of the industry. India's specialisation in IT is of special interest due to several reasons, first because India is a developing country and the production of information technology goods and services is often associated with industrialised countries. Second, the Indian IT industry evolved and grew through foreign export and not first through the development of demand from the domestic sector, which is the common form for a sector to develop and grow.

This paper tries to give an explanation for India's specialisation in the IT industry using economic theories of international specialisation and analysing factors that have been important for the development. The comparative advantage of high skilled labour at a low cost and the liberalisation of the economy, which shifted the development strategy from import substitution to export orientation, are often used to explain the development of the IT

industry. Thus, this study indicates that there are more factors that have contributed significantly to the development of the industry.

## **1.1 Aim**

The aim of this study is to use economic theories of international specialisation to analyse selected factors that have been important for the development of the IT industry in India and the resulting specialisation in the IT sector. After the factor analysis, the future of the sector is discussed in terms of prospects and obstacles in order to consider a sustained growth and development of the sector.

The main questions studied are:

- Why has India been successful in the development of an IT sector?
- Which are the most important factors for the development and specialisation of the Indian IT industry, and how have they affected the growth of the sector?
- What are the prospects for the future and what are the constraints for a further development?

## **1.2 Method and material**

This is a qualitative study of the Indian IT sector, executed through a field study in Delhi and Bangalore, India in 2006. Using economic theories of international specialisation, comparative advantages, economic liberalisation and foreign direct investments, factors important for the Indian IT industry's development have been analysed. Due to the structure of the Indian IT industry, with a greater production of software products and services, there is a focus on software and ITES-BPO (Information Technology Enabled Service-Business Process Outsourcing) industry, while hardware is only discussed where it is relevant.

The material on which the study is based is collected from primary sources e.g. interviews and secondary sources such as; volumes, academic articles and electronic sources. The face-to-face interviews, which were semi-structured and consisted of an open conversation with a respondent, have provided a deeper knowledge of the subject. In the interviews the

respondents were asked to rate the factors that in their opinion are most significant for the growth of the IT industry in India. The majority of the respondents rated the same factors among the most significant factors for the IT industry. The selection of factors for this paper is based on the highest rated factors from the interviews and factors mentioned in the secondary sources. There was relatively unanimity in the answers in the interviews and therefore the references are to *various interviews* instead of a specific respondent. The credibility of an interview can be questioned depending on the subjectiveness of the respondent. To increase the reliability of the material collected from the interviews, twenty-seven interviews were conducted and involved respondents with different professional careers, representing, among others, academic institutions, IT organisations, companies, public institutions, and IT journals.

## **1.4 Structure of the paper**

The paper first is an introduction and overview of the Indian IT industry, incorporating a definition of the IT industry, the development of the Indian IT industry, the domestic and export markets, location and employment in the sector and the technology level of production. Thereafter follows a discussion of economic specialisation and the economic theories of Heckscher-Ohlin and Ricardo and comparative advantage, the possibility of exploiting a comparative advantage, the import substitution strategy versus the export-oriented strategy, foreign direct investment and industry policies. In chapter four factors determining a specialization in the IT industry for India are analysed. Chapter five discusses prospects and obstacles for further development of the sector. The last chapter summarises and concludes the analysis of the Indian IT industry.



## 2 The Indian IT industry

The Indian IT industry is relatively new and has experienced high economic growth during the last two decades. The IT industry's contribution to the Indian GDP increased from 1.4 per cent in 1999 to 3 per cent in 2004. It is an export oriented sector where a large share of the revenues represents export and a small share the domestic segment, though there has been an increased growth of the domestic segment during the last years. The products and services in the sector have changed production technology from mostly low-end work to more high-end work. The chapter first defines the IT industry and then gives a description of the development of the Indian IT industry. Thereafter the export and domestic markets are discussed. The export segment is more thoroughly discussed, due to its greater size of the total revenue, through a description of the offshore production and market. The chapter finishes with a discussion about the production of IT products and services as a result of the development of the IT industry.

### 2.1 Definition of the IT industry

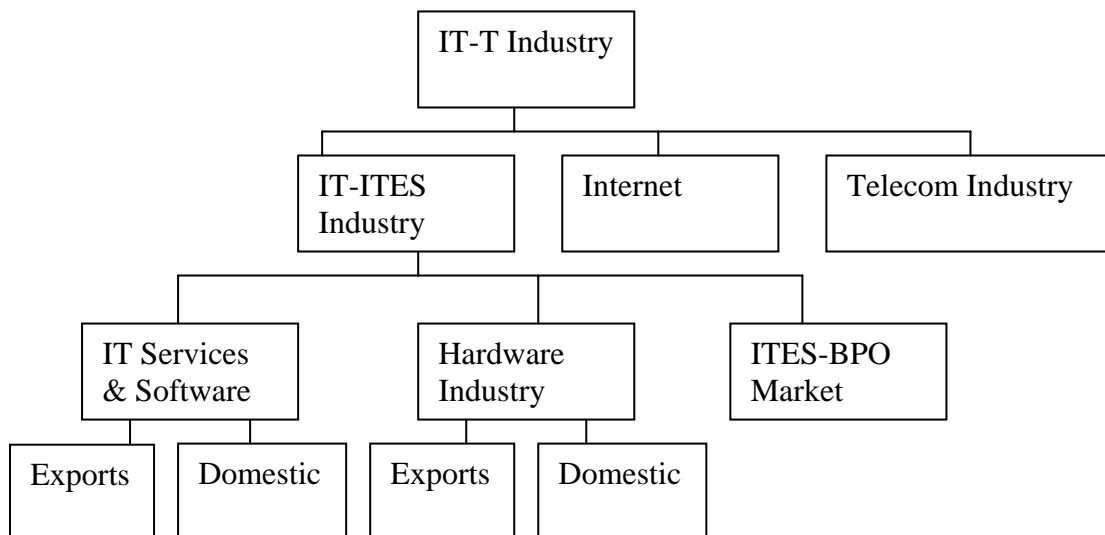
The National Aeronautics and Space Administrator (NASA) defines information technology (IT) as *“Any equipment or interconnected system or subsystem of equipment, that is used in the automatic acquisition, storage, manipulation, management, movement, control, display, switching, interchange, transmission, or reception of data or information.”* (NASA 17-11-06). The equipment and systems in information technology can be divided into two subgroups, software and hardware. Hardware refers to physical products such as components of processors and storage- and communication devices. Software refers to the instructions that control the flows and processing of information in digital form, in and between different hardware products. The hardware design contains and uses the software code, implying an overlapping of hardware and software. The production of hardware is distinguished from the production of software by its classification within the manufacturing sector, and requires well developed infrastructure and large scale investment, while software development is labour intensive and knowledge based. (Sathish 2006:225). The software segment of the IT industry can be divided into subgroups;

- Consulting services, including, among others, programming, testing, and support.

- Software product development, concerning all from market research to the design and development of a new product.

Business Process Outsourcing (BPO)/ Information Technology Enabled Services (ITES) refers to a wide range of services for different sectors and are not directly included in the definition of information technology. However in this paper BPO/ITES is included in the information technology because of the industries frequent use of software and hardware in the work and distribution, and it is difficult to separate these services from other services in the IT sector. Below the IT industry is illustrated by a schematic picture in order to give a clarification of the different segments.

**Chart 2.1 A schematic picture of the IT industry**



Source: Fredrik Fexe, Swedish Trade Council

## **2.2 A description of the Indian IT industry**

### **2.2.1 The IT industry**

The Indian IT industry is foremost located in a few cities. The development of the Indian IT industry started in Bangalore, a city with a large pool of engineers. Bangalore continues to be the IT centre of India, but due to the fast development of the industry the IT companies have established in more cities such as Hyderabad, Chennai, Pune, Mumbai and Delhi. (Kumar 2006, interview:22.09.06).

In the early 1960s foreign companies supplied the Indian market with software. The demand for a variety of software increased, and organisations and companies started to develop home made software programs. With the increasing demand for software, companies saw the potential in the development and export of software. The first Indian software firm, Tata Consulting Services (TCS) was founded in 1968 and began to export software in 1974. Soon other Indian companies like Wipro and Infosys followed and are today major actors in the Indian Software industry. (Heeks 1996:68f). The domestic demand for software continued to increase and more Indian companies were established. In the middle of the 1980s the American companies Texas Instrument (TI) and General Electric (GE) established in India and soon more foreign companies arrived. (Ramachandra 2006:4).

In the 1970s Indian engineering students moved to the US for post graduation and after graduating they stayed and worked in the US IT industry. Rajiv Gandhi was elected Prime Minister of India in 1984 and his vision was to transform India into a technology using country and prepare the country for information technology and enter the new millennium with good IT skills. The New Computer Policy in 1984 and The Policy on Computer Software Export, Development and Training in 1986 were implemented which put focus on the IT industry in the Indian economy. (Frankel & Sen 2005:11). The demand for software increased with the technology shift towards network oriented systems and customised software in countries using high technology, and by the arrival of personal computers. (Arora et al. 2001:1270f).

In the beginning of the 1990s the government implemented economic reforms and liberalized the economy. It also decided to especially promote the sector and turn it into an area of growth in the economy. During the last decades, besides the global recession in 2001, the Indian software industry has experienced a constant high growth. (Ramachandran 2006:7ff). The global demand for IT services continued to increase with the development of the IT industry. The demand for Indian IT services increased with the “year 2000” problem in software, which was quite easy to solve but required a large amount of engineers and good project management capabilities. There was a shortage of these in the industrialised countries but India had skilled people who could work with the problem.

In the end of the 1990s a new branch in the IT industry, ITES-BPO, evolved and has since then had a high growth and today employs a large number. The branch consists of administrative services, customer support services, IT help-desk services, medical transcriptions, which are low-end work requiring less skilled personnel. From the BPO business, KPO (Knowledge Process Outsourcing) has evolved, including services such as

market research, investment banks and financial services, which demand more knowledge and are at a higher stage in the value chain of production.

### **2.2.2 Employment**

In 1999, 284,000 people were directly employed in the IT sector, and in 2004 over one million. The industry has led to job opportunities in other sectors through indirect and induced employment. (NASSCOM, 14-12-06). The most demanded profession in the sector is engineers, though all work tasks in the industry are not high skilled, the less skilled work being mostly found in the ITES-BPO segment. In general the wages are higher in the IT sector compared to other sectors in the society. During the last years, the wages have increased by an annual average of 16 per cent. Mostly young people are working in the industry and in 2000 the median age was 25.7 years. (Kumar 2005:109).

The share of women in the IT sector is 25 per cent. The high share of women in the sector gives the IT sector an employment structure other than the more traditional sectors in India, where women are less likely to be found. The recent development of the sector and the more international character of the IT sector facilitates the entry of women into the sector. Despite the higher share of women in the software sector, their role is still subordinated and fewer women are employed in higher positions.

## **2.3 The IT industry markets**

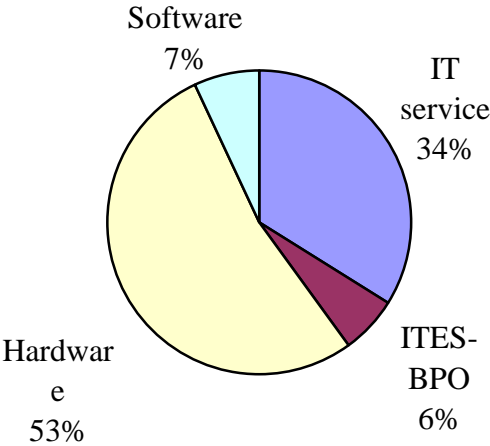
### **2.3.1 Domestic market and export market**

In 2005 the domestic share of the Indian IT industry was 36 per cent while the export segment corresponded to 64 per cent, which indicates an export oriented sector. The size and the growth of the domestic IT industry have always been smaller than the export segment. However, in the middle of the 1990s there was a change and the domestic growth rate started to catch up. The domestic sales in software increased from US dollar 140 million in 1992 to US dollar 2.45 billion in 2001 and is continuously growing. When hardware and ITES-BPO are included, the total domestic IT industry sales reached US dollar 8.2 billion in 2004.

The share of export in Indian IT industry is dominated by a few large companies. In 2001 the five largest Indian IT companies accounted for one third of the total Indian IT export. The

export increased in the beginning of the 1990s, which could be seen in the increase of annual software export. In 1985 India exported software for US dollar 24 million, in 1992 the annual export had increased to US dollar 164 million and in 2002 it was US dollar 7.8 billion. (Murthy 2004:217). India’s main export markets are Europe and the US, and in 2003-04 the export shares to the US and European markets were 69 and 23 per cent respectively of the total Indian export. Despite the concentration on the US market, Indian companies have started to penetrate new markets such as Singapore and Australia. (NASSCOM 2006:5). For a more detailed overview of the export destinations of the Indian IT-ITES services see appendix 1.

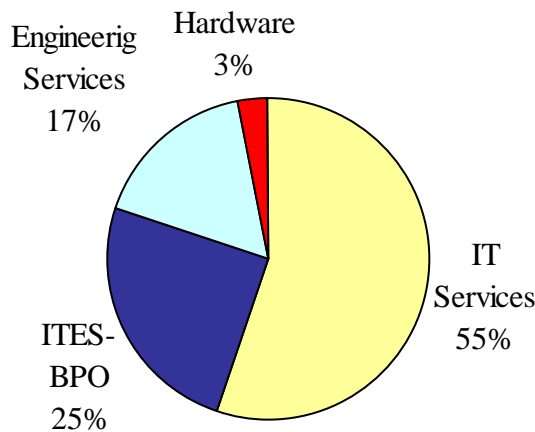
**Chart 2.2 Composition of the domestic IT industry in 2005**



Source: NASSCOM 2006

Besides the differences in the size of the domestic and export segments of the Indian IT industry, they are also distinguished in terms of composition which could be seen in chart 2.2. In the domestic industry hardware corresponds to 53 per cent of the total sector, while IT Services corresponds to 34 per cent, software to 7 per cent and ITES-BPO to 6 per cent. Despite the large segment of hardware in the domestic industry, the demand has started to shift towards more services and management. There is also an increased demand for total solutions of software, which incorporates software applications, maintenance, support and training. ITES-BPO is a new segment that has evolved during the last years and now has a high growth. (NASSCOM 2006:46,106ff).

**Chart 2.3 Composition of the export in the IT industry in 2005**



Source: NASSCOM-McKinsey Report 2005

The export segment of the Indian IT industry is shown in chart 2.3 where IT Services corresponds to 55 per cent, while the share of hardware is marginal with 3 per cent. Despite the young age of the ITES-BPO industry it has grown and corresponds to 25 per cent of the export segment.

### **2.3.2 Offshore work**

Offshore activity is defined as an organization which is in contact with another firm to operate and manage their business processes. The global IT and BPO industry has developed toward offshoring of production and services. In 2005, India received 65 per cent of the total offshoring, and their share of global BPO was 46 per cent. Both have increased since 2001 when India's share was 62 and 39 per cent respectively. (NASSCOM-McKinsey Report 2005:13).

Exports of software can be categorized into onsite consultancy, a mix of onsite and offshore work and offshore development centres, depending on the location of the software development. The onsite work is carried out at the location of the foreign company (here: the domestic country is India), but the Indian company provides skilled labour to the customer on the basis of a specific demand. A mix of onsite and offshore work takes place when the Indian company first sends employees to the customer's location for analysing and training in the system and then develops the software in India on the basis of the specifications brought back. The offshore work involves a contract with long-term agreement on prices and materials and

is carried out at the Indian companies' domestic development centres. There is a difference between onsite and offshore work; in offshore work advantage is taken of the wage rates in the offshore destination while the onsite work does not have the same advantage due to the work being performed in the country of the client. (Arora et al. 2001:1275).

**Table 2.1 Offshore-onsite export mix 1994-2005**

Year	FY 94	FY96	FY98	FY00	FY02	FY04	FY05E
Offshore	38%	40%	41%	43%	55%	64%	71%
Onsite	62%	60%	59%	57%	45%	36%	29%
Total	100%	100%	100%	100%	100%	100%	100%

Source: Ramachandran 2006:15

The pattern of production of software exports has changed from onsite to offshore work. In the 1980s and the beginning of the 1990s mostly onsite, low value and labour intensive work, such as coding and testing was performed. In 2002 the offshore export exceeded onsite export. Table 2.1 shows the shift in software export production from onsite to offshore activities between 1994 and 2004. (Ramachandran 2006:15).

## 2.4 Value-Chain

There is a discussion about the Indian IT industry's position in the value chain. The position in the value-chain is a result of the technological and managerial development the industry has undergone in the last decades. The value-chain of the Indian software industry is represented by a number of stages reaching from low-end to high-end work. The first stage is Data-Entry and Data-Transcriptions, services performed in India. The next stage is Body Shopping, onsite work based on a contract. The third stage is Offshore Development, and the fourth is Customized Solutions, which includes application software development and for example development of methodologies, and creation of processes which facilitate and increase the time effectiveness of similar work performed a second time. It could also be development of the export markets for packaged software or services. The design of a product requires market knowledge while testing requires technology knowledge, both of which are

high paid services due to the knowledge intensiveness. The next stage of the value chain is Premium Services. The well known and large companies brand their products as premium, which assures quality and reliable delivery times, thus resulting in a higher price of the products and services. At this stage Niche Technology companies develop specific knowledge products in a sector, which facilitates climbing the value chain and producing higher-value products for companies. The last and most complex stage is product development. It contains the whole process from market research, design and specification to development of a complete product. (Bajpai & Shastri 1998:23ff).



### **3 International specialisation and industry policies**

The increased possibility for countries to trade due to decreased trade costs and reduced barriers to trade together with higher incomes can lead to increased trade and specialisation in production. Specialisation can be a result of trade and development and expansion of a sector where the country has a comparative advantage in production. The specialisation implies an increased production of particular products instead of producing all goods and services demanded, although the specialisation does not need to be complete and the country can continue to produce a variety of goods, which can lead to increased productivity and increased incomes in a market economy. A country can have natural comparative advantages but it could also create them or strengthen already existing comparative advantages through an implementation of direct measures such as industrial policies. Developing countries can have difficulties in exploiting their comparative advantages and increasing demand for their products in the international market. This can be explained by reputation that can also affect which goods are exported. A shift in the development strategy of a country from import substitution to export orientation, facilitates the exploitation of comparative advantages when the country is able to obtain other goods and services through international trade and does not require to produce all goods domestically. The amount of foreign direct investments also affects the specialisation patterns.

In this chapter international specialisation is first studied with a focus on comparative advantages and the endowment of resources according to the economic theories of Heckscher-Ohlin and Ricardo. The theory of reputation by Vinayak Banerjee is discussed in terms of the possibility of exploiting a comparative advantage and specialising in production. The possibility of trading and exploiting the comparative advantages are analysed through reform policies including import substitution and export oriented strategies of development. Thereafter Rodrik's theory of industrial policies and created comparative advantages is presented and then FDI (Foreign Direct Investments), spillovers and agglomeration effects.

#### **3.1 What determines international specialisation?**

The increased opportunity for global trade has led to an increased trade and the possibility of exploiting comparative advantages and specialising in production, not necessarily fully. In

economic theory, the trade and pattern of specialisation can be determined by, among other things, different technologies or relatively different factor endowments between countries. According to Ricardo, a country engages in trade because of different technologies between countries and specialises in the production of a good in which it has a comparative advantage. The comparative advantage is decided through comparing across countries the opportunity cost of production, that is the amount of resources to produce a specific good that must be given up in order to produce one more unit of the other good. A country has a comparative advantage in the production of the good with the lowest opportunity cost compared to other countries. Even if one country has an absolute advantage in the production of all goods, total world output will increase if all countries specialise in the production of the good in which they have a comparative advantage. The model assumes one factor of production labour, and different technologies among countries. A comparative advantage in production of a good implies that a country is closer to the international technology level and productivity in that particular production than in the production of other goods. (Suranovic 27-11-06).

Heckscher-Ohlin first developed a theory of trade and international specialisation in the 1920s, which later was elaborated by, among others, Paul Samuelson and Jaroslav Vanek. The model assumes two factors of production, labour and capital and same production technologies in all countries. According to the model, countries trade because of relatively different endowments of production factors within and across countries. When moving from autarky to free trade, a country can specialise in the production and be a net exporter of goods that use the relatively abundant factor more intensively. According to the Heckscher-Ohlin theorem, a labour abundant country will specialise in the production of labour intensive goods and a capital abundant country will specialise in the production of capital intensive goods. The model can be extended to incorporate more factors of production and the production factor labour can be divided into skilled and unskilled labour. The amount of skills among the population in a country depends on the resources invested in education and, because raising the level of average skills takes a relatively long time, labour could be seen as different production factors. It could be relevant for economic analyses to divide the production factor labour into skilled and unskilled because the average worker in a developed country has normally higher human capital than an average worker in a developing country.

Trade in products can be seen as trade in production factors, where an increased demand for a product results in an increased demand for the factor of production most intensively used. A country will be a net exporter of the factors of which it has a relatively larger endowment compared to the rest of the world. According to the Stolper-Samuelson theorem,

the increased trade leads to an increased price of the goods using that factor intensively and a decreased price of the factor used less intensively in production. A rise in the price of a labour intensive good in a labour abundant country results in increased wages while the price of capital falls. The factor price equalization theorem states that when prices of outputs are equalized then factor prices also become equalized, though total price equalization is not likely to occur. A shift in the capital to labour ratio in the production of a good will lead to a continued production of labour intensive goods for a country specialised in the production of a labour intensive good, but with more capital intensive production techniques than before. (Kaempfer et al. 1995:98ff).

Developed countries have a higher capital to labour ratio compared to developing countries and are capital abundant while developing countries are labour abundant, implying a net export of labour intensive goods from the developing countries. Export from a developing country can be associated with a “country of origin risk” implying a negative attitude of developed countries towards products and services produced in developing countries. It could therefore be difficult for developing countries to export their goods to developed countries and exploit their comparative advantages. (Mukherji & Ramachandran 2004:212f). The “country of origin risk” can be reduced by increased information and the building of a reputation. A reputation takes time to create and incorporates expectations of quality, brand name and trust between the business partners. According to the economic theory of Vinayak Banerjee (2006) the reputation can affect which of the goods produced by comparative advantages that will be net exported to the rest of the world. Without a reputation, the demand could be less than with a good reputation for products from a developing country, implying a smaller export than possible. An industry is therefore dependent on a reputation in order to fully be able to benefit from the exploitation of comparative advantages. The reputation can be of less importance for a developing country if there exists a well developed court system, trade relations with other developing countries, a public scoring system, functioning capital markets and an economic environment open for MNCs.

Reputation can be seen as an advantage independent from the revenues similar to a fixed cost, and will continue to be an advantage as long as the quality of the products is maintained. When a multinational corporation with a good reputation moves to a developing country, the MNC will continue with the same production processes in order to ensure the quality of the products. They will require the same mix of employees, skilled and unskilled, implying a need for skilled people in the developing countries. (Vinayak Banerjee 2006:92ff).

## 3.2 Trade Liberalisation

The liberalisation of an economy often occurs when a country shifts from an import substitution strategy to export orientation and is a result of the implementation of economic and political policies with the objective to deregulate and open up the economy. A liberalisation of trade implies a reduction of trade barriers and increased possibilities and incentives for trade which can increase specialisation in production.

A closed economy implies an inward oriented import substitution strategy, with the long-run objectives of self-reliance, balanced growth and a diversified and competitive industry. The strategy promotes domestic production through an enlargement of domestic industries and increased tariffs and quotas, which act as barriers to trade. In sectors important for the country's development, increased protection is introduced to act as an incentive for the development of the domestic market. (Ray 1998:657). The effect of a tariff is a price rise above market price for domestic producers and consumers. Domestic producers become competitive assuming that the tariff plus world market price are higher than production cost and the domestic consumers substitute the imported goods with domestically produced commodities. The government obtains tariff revenue equal to the size of import times the size of the tariff. Further effects will be an increase of domestic production and a reduction of import demand. A quota restricts the import quantity with an effect equivalent to the tariff in terms of domestic prices, production and import levels. Additional welfare effects from an import substitution strategy are among others, spillovers, increasing returns, learning by doing and assimilation of new techniques of production. One spillover effect is an increased demand for skilled people when the domestic industries develop. If the demand is met by an increased supply, the pool of skilled people in the economy can increase, and in the long run facilitate a further development of the economy. The import substitution strategy creates a climate where the domestic companies are protected against international competition and the production is inefficient. (Ray 1998:657ff).

An open economy uses an export oriented strategy promoting free trade through export policies, competition and improved resource allocation. The competitiveness results in increased efficiency, product improvement and technical change. It also creates a faster economic growth, which gives incentives to greater savings and investments, attracts FDI and generates foreign exchange. The strategy involves less government interventions and an economy led by market forces. (Smith & Todaro 2006:640). To facilitate the expansion of

export, a government uses several policy instruments such as duty treatments to lower tariffs on input goods used in the production of export goods, and easier access to credit in order to increase innovation by a lowering of interest rates and increased loan sizes. The export subsidy promotes export through an acquirement by the exporter of an ad valorem subsidy for every unit exported. The effects of the subsidy are a higher price both for domestic consumers and producers leading to an increased domestic supply, a decreased domestic demand and an increased export. (Ray 1998:678ff).

### **3.3 Industry policy**

In order to increase the profitability of specialisation in production where the country already has a natural comparative advantage, it is possible to create comparative advantages through industry policies directed towards the sector. The government's role in economic development is a matter of whether it should intervene or if the economy should be left to the market forces. According to Dani Rodrik (2004) the government and industrial policies have a central role in development because economies are not by themselves able to overcome market failures that affect the structural transformation necessary for development. The theory promotes economic restructuring, diversification and new technologies and states that the government should cooperate with the private actors and intervene when the market forces are not sufficient to create a climate for economic development.

According to Rodrik, a country has to engage in new economic activities, mainly in non-traditional sectors to reach a higher state of development. The economic activities are dependent on specific inputs, such as infrastructure, new technology and skilled labour. Some inputs can be provided by the market but not all, implying that the state has to intervene and provide inputs for economic activities. The intervention is carried out by industrial policies which are general activities rather than industrial specific that restructure the economy and are, among others; provision of infrastructure and education possibilities, adoption of new technology for local conditions and access to risk and venture capital. (Hausmann & Rodrik 2006:36ff).

### 3.4 Foreign Direct Investment and Spillovers

The motives for Multinational Corporations (MNC) to invest abroad are increasing profits through exploitation of the host country's comparative advantages and the access to new markets and natural resources. Among economists FDI is positive, and the benefits from capital formation, employment, exports and technology, are considered to dominate the negative aspects of foreign ownership and capital flight. (Blomström & Kokko 1997:2). Due to different characteristics, countries are more or less attractive locations for foreign investments. Factors influencing localisation of investment decisions for MNC:s are market access, stable social and political environment, ease of doing business, reliability and quality of infrastructure and the opportunity to hire a skilled workforce. (Worldbank 2002:19). The comparative advantages of the host country are of interest for the MNC:s when they are searching for production advantages for a particular sector. The exploitation of a country's comparative advantage and foreign direct investments expand the production and increase the patterns of specialisation. The MNC:s depart from the host companies when they enter the foreign market because:

- They bring new technologies, a firm specific advantage which increases their competitiveness against the domestic companies even though they have comparatively less knowledge of the domestic consumers and market.
- The entrance of a MNC disturbs the market equilibrium, which forces the domestic companies to act.

The new technologies are expected to create spillover effects that lead to productivity improvements for the domestic firms. (Blomström & Kokko 1997:2). Productivity spillovers occur when the presence of a MNC generates more productivity or efficiency benefits than it can internalise, resulting in domestic companies being able to benefit from the spillovers created by the MNC. (Blomström & Kokko 1998:3).

The economic literature of FDI identifies four different channels through which spillovers can affect the productivity of the host company and these are; imitation, skills acquisition, competition and exports. Imitation implies a copying by the domestic firms of technologies or production processes used by the MNC, resulting in a productivity increase for the domestic firms and an upgrading of the local technology or production processes. Most MNCs demand relatively skilled labour in comparison to the average level of skills in the country. Therefore, it is common for multinationals to invest in additional training of their employees to obtain

the skills demanded. Skill acquisition occurs when skilled workers leave the MNCs for a domestic company. Productivity improvements can then be generated through an immediate spillover of knowledge, such as knowledge of new technology or management techniques, to other workers in the domestic firm. When a Multinational Corporation enters a new market, the competition in the market increases and forces the domestic firms to increase their productivity in order to be competitive. In the long run, an increased productivity results in increased efficiency levels for the domestic firms. The productivity increase occurs through using their existing technology more efficiently, applying new technology or imitate the MNC:s technologies. The domestic firms can study the export strategies of the Multinational Corporations and learn and develop their own strategies which will increase the productivity. A successful export strategy involves knowledge of the export market and a distribution network. Most MNC:s already have comprehensive information on export markets due to international contacts and well developed networks. (Görg & Greenaway 2003:2ff).

According to the new economic theory of localisation a multinational corporation chooses the location for the establishment, depending on the different advantages of the regions in the country. First, the theory assumes two regions, two goods and high transport costs where both regions produce both goods. When transport cost decreases the regions start to trade with each other and when transportation cost is low enough, the regions can specialise in production. Companies will localise in a region where a similar industry is already established. The location decision is explained by created advantages from the existence of other companies in the region, which creates spillover effects between the companies. The created advantages are referred to as forward and backward linkages between the companies. Backward linkages are created through companies' demand for intermediate goods, which exert a backward pressure for setting up industries to supply the new companies. Forward linkages are created through one industry's use of another industry's output as input. The linkage effects created by the establishment of an industry lead to growth of new industries. (Krugman & Venables 1995:860f).

## **4 Factors explaining the success of the IT industry**

Historically, economic growth of a sector is led by a development of the domestic market. In contrast the Indian IT industry has developed through demand in foreign markets, resulting in an export oriented sector. The Indian IT industry has experienced growth during the last decades and factors explaining the Indian specialisation in IT have been discussed. From the beginning, the explanation for the development was India's comparative advantage in skilled labour at a low cost, a cost advantage that was expected to disappear when the wages rose. The sector's continued growth and development despite rising wages, indicates that the advantage for the IT industry consists of more than the low cost of high skilled labour. With the economic theory of industrial specialisation, trade liberalisation and foreign direct investment factors important for the development of the IT industry are analysed. The factors are; cost advantages, a well educated workforce, economic reforms, state interventions and increased information about the Indian IT industry. According to economic theory, trade and resulting specialisation can be explained by an exploitation of comparative advantages in either relative factor endowments or technological differences between countries. India has a relatively large endowment of high skilled labour compared to capital and can specialise in production of high skilled labour intensive goods when exploiting its comparative advantages. In the beginning of the 1990s the government reformed the economy and shifted from being a closed economy with an import substitution strategy to an export orientation strategy. The liberalisation opened up the economy for trade and foreign direct investments and facilitated an exploitation of the comparative advantages. The Indian government has intervened in the IT sector and promoted the sector through implementing industry policies. India has increased the information and the trust in the Indian IT industry through the development of a global reputation.

### **4.1 Cost advantages and increased efficiency**

In the Ricardo model, trade and comparative advantages are determined by different technology between countries, implying different productivity. India has a comparative advantage in the production of IT services due to a relatively lower opportunity cost in terms of relatively lower wages for skilled labour. India's comparative advantage in the IT industry



implies a higher productivity in this sector than other sectors in the Indian economy, meaning that the IT industry is close to the industrialised countries' productivity levels. The IT sector is characterised by labour intensive high technology production which does not require large financial investments and is compatible with the characteristics of India. (Suranovic 27-11-06).

India's large endowment of skilled labour, in relation to capital within the country and compared to other countries creates, according to the Heckscher-Ohlin model, a comparative advantage in the production of high skilled labour intensive products and services, and when the country trades it can be specialised in the production of labour intensive goods and also a net exporter of those goods. Most of the production in the IT industry consists of high skilled labour intensive work, resulting in a comparative advantage in the production of IT products and services for India and a possibility of specialising, not necessarily fully in the IT industry, and being a net exporter of IT services and products. India's high labour to capital ratio implies relatively smaller returns to labour than to capital, which is showed in relatively lower wages. In labour intensive industries, total costs, to a great extent, are represented by wages, implying that India has a cost advantage in labour intensive work. According to the model, low wages are a result of the endowment of factors and not a result of lower productivity, due to the theory assuming the same technology in all countries, which implies that India has a comparative advantage in high skilled labour represented by the cost advantage in low wages.

The price of IT products and services is reflected by the cost of wages, and in world competition the relative cost of wages between countries becomes more important than the absolute cost. In 2000 the wage cost in the Indian IT sector was between one third and one fifth of the US level. Despite the relatively low Indian wages compared to the international levels, the wages in the domestic IT sector are high compared to other sectors in the Indian economy. The increasing wages can, in the Heckscher-Ohlin model, be explained by specialisation in the industry as a result of exploitation of the comparative advantages. The specialisation leads to an increased production and export of IT products and services. Trade in goods can be seen as trade in factors, and when India starts to trade IT services there will be, according to the factor price equalization theorem, an equalization of factor prices between countries and therefore a rise in the price of the goods produced by the abundant factor. (Kaempfer et al. 1995:98ff).

The relatively higher demand of IT professionals than the supply leads to higher wages and to a higher attrition rate in the sector, making it more difficult for companies to retain workers. The high attrition rate can have a negative impact on the company, due to loss of

employee-specific knowledge, knowledge leakages to other companies, delays of projects and a loss of credibility. To retain employees, companies carry out education and training, offer stock options, management career paths, flexible schedules, wage bonuses, mentoring, housing and health benefits. (Athreye 2005:155ff). The measures induce a higher cost per employee, which results in a higher price of the production factor skilled labour. Though rising wages, the endowment of factors of production in India has not shifted, implying that the comparative advantage still is in labour intensive production. A continued specialisation in the IT sector is therefore motivated by a relatively large endowment of skilled labour and the relatively low wages.

Despite the comparative advantage in labour intensive work, the rising wages in the IT sector provide incentives for the Indian companies to improve software development practice and develop tools and software processes to decrease the production costs in order to become more competitive at the world market. It also gives an incentive to a more efficient use of labour, carried out through a reallocation of labourers. Engineering graduates, with lower wages, are employed for less qualified work tasks and the qualified employees, with higher wages, are reallocated to perform only high-end work. (Arora et al. 2001:1280ff). The higher wages and the increased competition associated with the liberalisation of the economy have resulted in a more efficient production of IT products and services. The increased efficiency, created by the introduction of large scale operations that permitted a splitting of the software tasks, the development of software processes that standardise production, automating of parts of the writings of software codes and a more efficient use of labour, promotes a growth of the IT sector. (various interviews).

## **4.2 A skilled workforce**

According to the Heckscher-Ohlin theory India is relatively labour abundant and can specialise in labour intensive production. Labour as a production function can be divided into skilled and unskilled labour. Even though a small percentage of the population in India is educated, the absolute number is large due to the size of the total population. In the last years approximately 120,000 engineers have annually graduated, to be compared with the annual 63,000 graduates in the US. The share of the Indian IT industry in the global IT industry is growing and therefore the relative endowment of high skilled labour becomes important for a

possible growth of the industry. The activities in the IT industry are skill intensive and therefore dependent on educated labour such as engineers. The large absolute number of engineers in India, suitable for work in the IT sector relative to other sectors and countries therefore becomes important.

The comparative advantage of a relatively high endowment of skilled labour is created by the government through industry policies directed towards the education system and could therefore be seen as a created comparative advantage for the sector. India has the largest system of education in the world with its 366 universities, 14,600 colleges and 900,000 students. (Kumar 2006:325). The large engineering reserve is to a great extent a result of the government's historical investments in higher education. The investments have received criticism, due to the focus on higher education instead of primary education. However, the focus on higher education has been critical for laying the human capital foundation needed for the IT industry. The endowment of high skilled labour has been increased through specific education supplied by companies and English as a medium of construction in higher education.

#### **4.2.1 The Indian education system**

Education is by tradition important in the Indian society, especially mathematics and science, which has resulted in a focus on engineering education in the education system by the government. The focus on mathematics and science suits the IT industry well because of the mathematical structure of the technological underpinnings of software. (various interviews). The traditional focus on these subjects has resulted in the existence of a large pool of high skilled engineers, which directly could start to work in the IT industry.

India had one of the first education systems in the world. In the beginning of the 1900s the National Congress stated that the education system would focus on technical training. After independence, India's first Prime Minister Nehru, promoted education for all as a cornerstone for the development and unifying of the country. Nehru ruled according to the import substitution strategy and wanted to turn India into a self-reliant state and therefore needed skilled people for the development of the Indian sectors. The focus on mathematics and science resulted in the establishment of technical institutions such as the IITs (Indian institute of technology). The first was established in the 1950s and several have since then been established in the major IT and software centres. (Lall 2005:2). The Kothari

Commission, which was set up in 1964 to formulate an education policy in which education would be free and compulsory for all children up to 14 years old. And later through the introduction of the National Policy of Education (NPE) by the government and the Prime Minister Rajiv Gandhi (NPE) with the aim to prepare India for the 21<sup>st</sup> century and the information technology development, through increasing access and improving the quality of education. In 1992 the NPE was updated, and the responsibility for the organisation and financing of the education system were established. Since the regulations of the establishment of private institutions were liberalised there has been an increased number of private engineering colleges and engineering graduates.

The higher demand for technical education that evolved with the development of the IT sector was met by the increased number of engineering colleges and universities. In the 1970s students from the top Indian institutes, foremost the IITs (Indian Institute of Technology), moved to the US for post graduate education. After graduating, a great number of students stayed because of work opportunities created when the IT industry in US grew at a high rate and increased the demand for engineers. At the same time the demand for engineering education in India increased and as a response, private engineering colleges were established, resulting in an increased supply of Indian engineers. (NASSCOM, folder 2005:6f). The high wages in the sector compared to other sectors attract workers, which results in an even higher demand for education compatible with the IT industry. Families are willing to invest in education of their children because of higher returns of skilled work. The increased demand for higher education and training has created market opportunities for private investors in education, since students are prepared to pay high tuition fees, with the knowledge of receiving a job after graduation. (Frankel & Sen 2005:22).

As the quality of the universities differs the knowledge of the students differs as well and students from, for example, the IITs are ranked as some of the best students in the world while students from universities of less quality are far below global standards. The high global ranking of the Indian top universities has led to an international attractiveness of these students resulting in many leaving India for work abroad. This started several years ago and was referred to as brain drain, a loss of human capital to foreign countries and a loss of resources invested in the education of a particular person. (Bhagwati and Hamada in Beine et al. 2002:276). In the beginning this was looked upon with fear but in the last decade there has been a shift in the opinion towards less significance of brain drain, because of the large available educated pool of engineers that exists today. There is now a discussion about a

reversed brain drain, Indians who before were working in the west are returning to India. (various interviews).

The central and state governments share the responsibility for the education system. Due to different economic resources of the states, the quality of the education differs, implying higher quality of higher education in the richer southern states. The quality of the university also has an impact on the economic development in the same way as the economic situation has an impact on the quality of the universities. The IT sector, which mainly is located in the southern states, is an example of the above stated development. (Lall 2005:6). The attractiveness of these locations due to a large pool of well qualified engineers has resulted in the establishment of many IT companies. The concentration of companies to these particular areas has created advantages for the companies, through the appearance of backward- and forward-linkages. The skilled engineers in these areas act as generators to the development of the IT centres, where agglomeration effects have occurred and made the centres even larger and more attractive to new companies. The IT centres have attracted both foreign and domestic companies. In the last years the agglomerations have grown and the negative aspects, such as increasing labour and real estate costs, of an industrial concentration surplus the positive aspects, which are the backward and forward linkages.

#### **4.2.2 English as an official language**

English was introduced to the Indian population by the British and made an official language by Nehru. By then, the British had already implemented it as the medium of instruction in most of the higher education institutions. English has been important for India in the development of the IT industry due to the international focus of the Indian IT industry. The main export markets for the industry is English speaking implying that a knowledge of English is needed in the communication with clients. Many of the work tasks in the IT industry, such as call centres with IT support and the development of customized software products, require a higher level of communication and therefore it is important that the employees speak the same language as the customers. The common language in the global IT industry is English and programs use it as a medium and therefore a knowledge of it is required. The implementation of English by the British and the appointment of English as an official language can be seen as directed policies in order to create a comparative advantage in an English speaking labour force for India. (Hausmann & Rodrik 2006:36ff).

An increased knowledge in English would, according to the Heckscher–Ohlin model, increase the relative endowment of high skilled labour to capital ratio in the economy and across countries and further strengthen the specialisation patterns and net exportation of labour intensive goods in trade due to an exploitation of comparative advantage. The comparative advantage of English is of importance to the IT industry in the competition with other low cost locations, in which the knowledge of English is scarce.

### **4.2.3 Integration between the industry and the academic institutions**

Traditionally the cooperation between the industry and the academic institutions in India has been poor but this changed with the economic reforms in 1991. The liberalisation of the educational system for private investors created more interactions between the industries and the academic institutions. The IT industry has taken a leading role in the collaboration between academia and industry. The outcomes of the cooperation for the educational institutions are an increased industrial awareness among students, allocation of resources to enable partnership and a platform in the academic environment where the industry can act as a spokesperson. From the industries' point of view, the cooperation has led to an allocation of more resources to academic institutions especially to experts in technologies and hardware/software infrastructure, senior managers teaching in academic institutions and development of programmes of new technologies that could be used by the faculties. (Joseph & Parthasarathi 2004:99f).

The industries' interest in education of the future labour force is acknowledged in education programs created by several of the major companies. To obtain required skills several of the major companies have started their own education centres where graduate students are educated to become future employees. The centres function differently, some provide an extensive education over several years, while others give introduction courses in order to prepare for future work in the firms. (various interviews). The increased cooperation between the academia and the industries and the specific training supplied by the companies have resulted in an increased number of graduates and a more suitable education for the IT sector. According to Rodrik's theory of industrial policies, this can be seen as directed policies toward a creation of comparative advantage in terms of a high skilled workforce for the sector and when trading the comparative advantage can increase the specialisation even further.

## **4.3 Economic Reforms**

The economic reforms implemented by the government in the beginning of the 1990s led to a change in India's development strategy from import substitution to export orientation. The shift opened up the economy and reduced barriers to trade, such as tariffs and quotas. The liberalisation consisted of reformation and policy changes in the different sectors of the economy resulting in an increased privatisation and a more investment friendly climate, which made it easier for domestic and foreign investors. The trade liberalisation led to an increased trade and made it possible for the Indian economy to exploit their comparative advantages and implement industrial policies to create and strengthen additional comparative advantages. The reformation of the economy facilitated the development of an export oriented IT industry and the exploitation of comparative advantages and a resulting specialisation in the production of IT products and services. The reformed sectors, which have affected the IT industry most and facilitated its development, are further discussed in this section.

### **4.3.1 Trade policy reforms**

The reform program facilitated trade through reductions in tariffs and non-tariff measures. The ability to import goods necessary in the production has been important for the whole Indian economy. The trade liberalisation has facilitated the development of the export oriented Indian IT industry. The development of IT as an export oriented industry was made possible by the reformation and the low domestic demand which implied that the companies had to turn to the global market in order to increase the growth rate.

Prior to the reforms the industrial policies were characterised by central government control over private investment. The government had limited production resources in scale and technologies and the industrial structure was inefficient. Through a restriction of the central government's control and a decrease in the number of industries reserved for the public sector the structure was altered. The IT industry had access to skilled labour which is necessary for the production of IT products though there was a shortage of domestic financial capital. The liberalisation led to the possibility for foreigners to invest in the Indian IT industry. Industrial licensing, i.e. companies need permission from the government to invest, was another means for the Indian government to control the industry and the concentration of

economic power. The industrial licensing acted as a barrier to entry and resulted in inefficiency and imperfect competition. The reformation led to an abolishment of licensing in most industries and opened up for private investors which resulted in the establishment of an increased number of companies and in increased competition and efficiency. (Bajpai 2002:11ff).

Before the economic liberalisation, manufactured consumer goods were completely forbidden to import. Among other goods, such as capital goods, raw materials and intermediates, some were freely importable while others required import licenses. In 1993 the reforms abolished import licensing on capital goods and intermediates. The reforms also reduced barriers to trade, and the average import duty was reduced from 72.5 per cent in 1992 to 24.6 per cent in 1997. The following four years the average rate increased to 35.7 per cent. Even if India's tariff rates have decreased since 1991 the tariffs were still some of the highest in the world in 2003. (Ahluwalia 2002:73f).

Before the reforms India was forced to rely upon technological imports from multinational companies due to a lack of domestic high technology production. In the 1960s the government did not allow private investments in the hardware sector, resulting in a larger dependence on foreign products. The government restricted the IT sector with a limitation of imports and through only allowing one state owned company in the production of hardware. The situation of one producing company became untenable because of high costs of production and long delivery times. In 1979 licenses to private firms for manufacturing and sale of computers were approved and the Sondhi Committee Report on Electronics recommended a relaxation of import restrictions, increased numbers of industrial licences and foreign collaboration. (Heeks 1996:55ff). In 1984 the New Computer Policy and the Policy on Computer Software Export were implemented by the prime minister Rajiv Gandhi. The new computer policy protected domestic producers from foreign competition through an implementation of a 200 per cent tariff on imports of finished computers, and encouraged the domestic producers through a reduction of tariffs on intermediates. The software policy in 1986 allowed for the first time imports of foreign software into India, but with a 60 per cent tariff. (Frankel & Sen 2005:11). For the IT industry, most companies are dependent on the import of hardware due to the relative small domestic market of hardware. Therefore the less restrictive rules for imports and the decreased tariffs have been of importance for a possible expansion of the IT industry.

Before the economic reforms import licensing had been motivated by balance of payment arguments. But when India changed the exchange rate from a fixed to a managed float of



currency this argument disappeared. Instead of using import licensing to impact the balance of payment, the more flexible exchange rate could be used to reach the same result. With the shift from a fixed to a managed float of currency the government devaluated the currency. The former over valued currency became depreciated which made the currency more attractive in the world market and additionally promoted export of Indian products. Due to the export orientation of the IT industry this facilitated the development of the industry, and made the IT services and products more competitive in the international market. The strong growth in the export segment of the IT industry since the beginning of the 1990s indicates that the economic reforms and the trade liberalisation have been positive for the IT industry.

#### **4.3.2 Reforms of the banking and financial sectors**

The reforms in the banking and financing sector have laid a foundation for entrepreneurship and investments, both foreign and domestic in the Indian economy and resulted in a more expansive economy. Due to the IT sector's young age and early stage of development when the reforms took place, the easier access to financial capital made it easier for entrepreneurs to start companies resulting in an increased number of companies and most likely a higher growth rate of the sector. Historically, but the banking system was completely public owned, the reforms deregulated the sector and opened up for private investments and facilitated entry into the Indian banking market for foreign banks, resulting in an increased competition in the banking sector. New financial institutes were created and a deregulation of the interest rates allowed banks to determine deposits and lending rates, the prior approval of the Reserve Bank of India for large loans was eliminated, and the sector became more market oriented. (Ahluwalia 2002:81). For the relatively new IT sector, the liberalisation of the financial and banking sector and the resulting increased access to financial capital have been important due to the fast expansion of new companies.

In 1992 the stock market was reformed, and a statutory regulator was established, including implementation of regulations that supervise the actors and their activities in the capital market. There was an increased participation of foreign investors in the Indian stock market which indicated a larger trust in the Indian capital market than before. The reforms of the stock market made it possible for companies to offer stock options to the employees which made it easier for firms to attract talented professionals. Due to the high attrition rate in the IT sector the possibility to offer stock options to retain employees was important for the IT

companies. The capital market reform in 1993 allowed Indian firms to be listed in foreign exchanges and implied a more thorough review of the Indian software companies by international technology analysts, which increased the credibility and the reputation of the industry in the international market. (Murthy 2004:219). The creation of a reputation could according to Vinayak Banerjee (2006) increase the possibility to exploit the comparative advantage and affect which goods are exported. The building of a good reputation for an industry can result in an increased specialisation pattern for that industry when the comparative advantage is exploited. (Vinayak Banerjee 2006:92ff).

The financial reforms also introduced current account convertibility which resulted in private persons and companies now being able to convert a larger amount into foreign currency. It also became easier to transfer financial capital in and out of India. (Harikumar 2006:278ff).

### **4.3.3 Reforms of the telecommunication and power sectors**

The reformation of the telecommunication sector started in the early 1980s, thus most of the liberalisation took place after 1994, with the new telecom policy. The main reason for the liberalisation of the sector was the demand for a functional and efficient telecommunication sector created by the development of the IT industry and the government's announcement to focus especially on the production of software services and products. A large share of the IT support and services are performed through the use of satellite links, internet, and broadband, implying that the industry therefore is directly dependent on telecommunication technology and not to the same extent on physical infrastructure and large financial investments. (Frankel & Sen 2005:14). Prior to the reforms the telecommunication sector was characterised by state owned companies and high costs. In the middle of the 1980s the American companies Texas Instrument (TI) and General Electric (GE) established in India. At the time the necessary infrastructure needed for the software industry in India was poor, with a lack of satellite links, and an undeveloped, expensive telecommunication sector due to regulations. To overcome the shortages in infrastructure TI brought their own satellite communication equipment. The liberalisation has opened up the sector for domestic and foreign private investors, which have resulted in lower cost for telecommunication due to the higher level of efficiency in the sector. The liberalisation has proceeded and today 79 per cent of the mobile lines in India is private owned compared to the 9 per cent of private ownership of fixed lines. During the last

years the reforms have concerned the cellular phones and the internet market, which are the new part of the telecommunication sector. Cellular phones were introduced to the Indian market in the late 1990s. (Mani 2005:281ff).

The development of the telecommunication sector was caused by the liberalisation of the sector but also by the global shift in technology, which altered the communication possibilities. The new technology increased the possibility to develop a global IT industry. The network of landlines in India is scarce, resulting in the inability to have a landline based telephone. Cellular phones are suitable for India because they are based on satellite communication and do not, require a land based network to the same extent as the landlines. Even though the cellular phones are more suitable for the Indian environment, the landline network is under construction together with internet connections via fibre-optical cables. The technological level of the telecommunication sector is near that of the industrialised countries implying, according to Ricardo, a comparative advantage in the production of IT products and services. (Suranovic 27-11-06).

The IT industry is dependent on the access to power. The electrical power sector was the first and the most difficult of the infrastructure sectors to liberalise. The reformation of the power sector has not been successful enough to create a functional power infrastructure in India. (Ahluwali 2002:78f). The IT industry has solved the problem of power shortages though with an establishment of power generators in the office buildings.

#### **4.4 Foreign direct investment**

According to the theory of FDI, foreign investors enter another market in order to exploit the host country's comparative advantages and to access a new market. FDI is accompanied by positive spillover effects in terms of new technologies, new production and management structures, skills and knowledge about the global market, which the domestic companies can take advantage of. During the import substitution strategy of development India had restrictive FDI policies which were liberalised and foreign investments were allowed, through the economic reforms during the shift to an export oriented development strategy. The software industry allows 100 per cent foreign investment and there has been a significant increase of foreign actors in the industry since the reformation of the FDI policies. One reason for foreigners to invest in the Indian IT industry is to exploit India's comparative advantages

in IT production and skilled labour at a relatively lower cost in order to increase the profitability of the companies. The relatively high endowment of skilled labour and the characteristics of the IT industry as a technology-based industry, which does not require a well developed infrastructure, and the possibility of a 100 per cent investment could explain the last years increase in the share of foreign investments in the Indian IT industry. In order to attract FDI to the different states the state governments intervene and create through industry policies such as tax reliefs and trade relaxation measures a favourable environment for FDI. The policies differs among states and some states are more attractive for investments. The southern states with the localisation of IT centres attract more FDI which indicates that industry policies directed towards attracting FDI lead to a higher amount of FDI in the sector, and have a positive effect on the specialisation patterns of an industry. (Hausmann & Rodrik 2006:36ff).

The presence of Multinational Corporations has created spillover effects to the domestic IT industry, which has increased the productivity in the sector and deepened the Indian economy's specialisation. The foreign investors bring new technology, which is absorbed and adopted by the Indian companies. Due to the high number of Multinationals setting up Research and Development centres in India, which mostly are performing work at the top end of the value-chain and increase the probability of technological spillovers to the Indian companies. Between 1997 and 2002 around 70 Multinational Corporations invested in Research and Development centres in India. Skills and knowledge from people coming from abroad are shared in the company where Indians are employed, resulting in possible spillovers. Other effects of foreign companies' entrance are an increased competition and new work opportunities, which have a positive effect on the sector's growth. According to the localisation theory of Krugman & Venables, the presence of foreign companies attracts more foreign investors due to the willingness to exploit backward and foreign linkages, resulting in an expansion of the India IT industry. (Krugman & Venables 1995:860f).

In the theory of Vinayak Banerjee, the presence of multinational corporations increases the possibility for the host country to build a good reputation. The entrance of global MNCs into the Indian market indicates an improvement of the reputation of the Indian IT industry. The MNCs demand high skilled labour in production, which increases the government's incentive to invest in education in order to be able to supply a skilled workforce and attract foreign investments. (Vinayak Banerjee 2006:92ff).

## **4.5 Policies directed towards the software sector**

The IT industry is a relatively new sector. Due to the young age and the characteristics of the sector, such as lack of physical final products and high technology, the government has a limited knowledge of the sector, which resulted in a hands-off policy. The hands-off policy implies fewer interventions by the government in the sector. Though the sector has not been left to the market forces, direct measures have been actively promoted and implemented by the government to create and strengthen the comparative advantages, which has led to an additional increase in the specialisation patterns. To promote the IT sector, the industry has established a trade body, NASSCOM (The National Association of Software and Service Companies). Reforms directly affecting the IT sector and the use of quality certificates are other industry policies used to support the sector.

### **4.5.1 NASSCOM**

The National Association of Software and Service Companies has made it easier for the Indian IT sector to gain a position in the global market. The trade body and chamber of commerce of the software and service industry was established in 1988. The main objectives for NASSCOM are to promote growth and facilitate trade and business in the software sector both nationally and internationally, and encourage research and education in software. The organisation is represented in several committees in the government of India and acts as a coordinator of the software industry, the government, and the global market. To support the development of the software sector and create an industry friendly climate, NASSCOM affects the government through lobbying. NASSCOM promotes free trade with zero tariff protection, deregulation of the telecommunication sector, creation of software technology parks and the implementation of strong intellectual property rights and data laws. (NASSCOM 07-11-06). The establishment of NASSCOM is an industry policy directed towards the IT sector, which will increase the information of the IT sector and promote it to the government in order to create comparative advantage in production of IT products and services, and will lead to an increased specialisation in the IT industry. (Hausmann & Rodrik 2006:36ff).

### **4.5.2 Liberalization of the software sector**

The IT sector was the first sector to be opened up to private domestic and foreign investors. The liberalisation of the software sector already started in the middle of the 1980s when the government established the Policy for Computer Software, which had the objective to promote the software sector. Since then, further reforms have been implemented and the sector is today one of the most export oriented sectors in the Indian economy. Reforms that especially promote the software sector are the following: no customs duty on imports of capital goods, no excise duty and no license required for imports of capital goods, raw materials, components and consumables. (Bajpai & Shastri:1998:5). The liberalisation of the sector has facilitated trade and increased the possibility to exploit comparative advantage and specialise in the IT industry and make it an export oriented sector.

### **4.5.3 Software Technology Parks India**

The government have promoted the IT industry and created comparative advantages for the sector through Software Technology Parks (STPI). The first STPI was established in Pune in the 1990s. The work in the software sector requires high-speed data communication links and short time of approval for certificates and clearances. A STPI incorporates a centralised in-house infrastructure and is a single point bonding area with export certifications meaning that office material coming into the office is duty free, but if taken out duty has to be paid. The access to high speed data communication in all office buildings which are STPIs has facilitated and promoted the development of offshore activities and is one explanation for the establishment of offshore development centres. The STPIs have assisted in the provision of work space to companies, especially to start-ups, encouraged entrepreneurs in the search for financial means and act as a single window clearance for administrative requirements.

To promote export orientation the companies are exempted from corporate income tax on all export revenues if the export surpluses a certain amount. Due to the export orientation of the Indian IT industry most of the companies reach the level of export that is necessary for the tax exemptions. (Bajpai & Shastri 1998:7f). The concept of STPI will last until 2008 and thereafter be renegotiated. The ongoing promotion of the software sector is questioned by other industries and the government has started to reconsider the special treatment given to the sector. (various interviews).

## **4.6 Improved information about the advantages of the Indian IT industry**

For international trade, a good reputation is important in order to create a demand for the goods produced. According to Vinayak Banerjee (2006:94) the reputation of a country together with comparative advantages can determine which products a country will export. A developing country can suffer from a “country of origin” risk, which is a result of imperfect information and prejudices and creates an unfavourable image of a country’s products and services. The “country of origin” risk can be reduced and the reputation improved by the creation of networks, the use of recognised quality certifications and work opportunities to show the skills. The reputation also depends on the economic situation and the functionality of the institutions in the country. Vinayak Banerjee (2006:94).

According to Banerjee & Duflo (2000) the size of export for a country is related to e.g. the reputation of the country. In a study by Banerjee & Duflo in 1995, the Indian IT industry had a relatively low export, thus it had comparative advantages in the industry. In the middle of the 1990s the IT sector was still new and had not yet created a global reputation, which could be one explanation for the relatively export levels. (Banerjee & Duflo 2000:1014). The reputation of the Indian IT industry has improved during the last decade and the export levels have increased during the same time. This supports the theory of Vinayak Banerjee that reputation affects the demand for and export of the products and services. (Vinayak Banerjee 2006:94).

### **4.6.1 Networks and quality certificates**

In the beginning, the Indian IT industry suffered from a “country of origin” risk but during the last years India has, been able to overcome the imperfect information and create a reputation in the global market through the establishment of networks and the certification of IT products and services. During the IT boom in the USA and the other developed countries, the demand for IT and software engineers surpassed the supply. In order to be able to proceed with the IT development in the industrialised countries, more engineers were required. India with its large pool of graduated engineers, was one of the few countries that could meet this demand. Indians had for a long time been working and studying in both the USA and UK, resulting in the development of networks which became important for the initial establishment

of contacts between the countries. The presence of Indians in the IT industries of the developed countries spread information about the Indian IT industry's skills and capabilities and built trustful business relations. Indian IT services became demanded with the millennium bug, a problem in software, in which the applications in the date field of the computer systems were not prepared for a millennium shift. The Indian IT companies got the possibilities to show their skills and with well performed work they improved the reputation of the Indian IT industry. The reputation was further improved by the listing of an Indian IT company at NASDAQ. (Kumar 22-09-06).

In order to guarantee the quality of production processes and products and services in the world market, the IT industry adopted quality standards and certifications which increased the information and reduced the "country of origin" risk. One world recognised software certification is the Capability Maturity Model (CMM) developed by the Software Engineering Institute (SEI) of Carnegie Mellon University in the USA. The CMM model started to be developed in 1987 and is a framework for the software development process. The SEICMM model made it possible to separate and offshore low skilled activities. The increased number of offshore activities and the shift from onsite to offshore work indicate an increased trust in the Indian IT industry. (Mukherji & Ramachandran 2004:212f).



## **5 Prospects and obstacles for the Indian IT industry**

The growth of the IT industry has recently increased; in 1997 the industry corresponded to 1.2 per cent of GDP, and in 2004 to 4.1 per cent. Here the future development of the IT sector is discussed, constraints and advantages for the sector are debated and recommendations are stated. Often mentioned limits are for example; infrastructure, supply of engineers, distance to customer markets, language barriers and low literacy rate. The importance of a company's position in the value chain for a further development is also acknowledged with one view of India being stuck in the production of low-end work and another that India has climbed the value chain. In this chapter the future development of the IT sector is discussed in terms of prospects and obstacles.

### **5.1 Prospects for the Indian IT industry**

The aggregate IT spending (hardware, software and IT services) worldwide according to NASSCOM is expected to grow more than six per cent annually over 2005-09 and spending on ITES-BPO over ten per cent annually, implying a continued high demand for IT products and services. A high worldwide demand is necessary for a sustained high growth in the Indian IT industry due to the export orientation of the sector and the relatively small contribution of the domestic segment to the growth of the sector.

The prospects, according to NASSCOM, for the Indian IT industry are bright, and they expect the export to grow from USD 16.3 billion in 2005 to USD 90 billion in 2008, and the domestic industry to grow from USD 4.2 billion to USD 50 billion. The growth of the Indian hardware sector is projected to be moderate due to proper and sufficient infrastructure supplied before the millennium. For an increased growth of the domestic market there has to be a higher demand for storage and servers in the economy, as well as an increased number of users of hardware and software in the Indian economy. The domestic demand is shifting towards services and management while the companies increase spending in network infrastructure and enterprise resource planning. The growth in domestic demand for IT-ITES in India during the last years has been at a steady high level and is expected to continue because of the strong economic growth and the rapid IT penetration of India. The increase in domestic demand for software is explained by e.g. the Indian middle class with a purchasing

power, and a computerisation of some key vertical sectors such as; banking, financial services, manufacturing, telecom and government institutions. In the forecast by NASSCOM, services are expected to be the continued key drivers of growth, a growth mostly generated by outsourcing.

The steady growth in export during the last decade is expected to sustain. The entrance of global companies can lead to spillovers such as the creation of new technology which can be absorbed by the Indian companies and improve their technology level. The competition created by MNCs entering the Indian market forces Indian companies to a more efficient production and supply of services, in order to be competitive. (NASSCOM 2006:125ff).

## **5.2 Obstacles for a future development**

Even though the prospects for the Indian IT industry are positive there are constraints. The growth and the expansion of the software sector require a large amount of high skilled people. If India can not manage to graduate IT professionals at the same rate as the demand for them increases, there will be a shortage of labour in the industry, which will act as a bottleneck for future growth. The shortages of labour supply also result in high attrition rates, which have a negative effect on the individual companies due to loss of knowledge and higher cost for retaining labour. The loss of knowledge has a negative impact on the quality of the products and services produced by the company and on the delivery time of the project, which can lead to a worsened reputation.

Before, rising wages were acknowledged as a problem and India's competitiveness would decrease in the global market and the businesses move to more low-cost locations. Today, it is of less concern because the quality of the products and services has risen with the wages, implying that competitiveness not only consists of low labour cost but also of efficiency in production. India's first mover advantage is another reason for the decreased fear of losing business to other low-cost locations. India is in the leading position because it is the first low-cost country entering the market and the Indian IT companies have gained market knowledge, developed processes and structures for the software development, and created networks, which new countries entering the market have to develop in order to compete with India. While the newcomers obtain this knowledge, India will develop a more mature industry.

A constraint for the Indian IT industry is the infrastructure in terms of telecommunication and access to power electricity. The sector requires a functioning infrastructure of telecommunication, satellite links, broadband and electricity. The supply of electricity is insufficient in India with frequently power failures. The shortage of electricity could act as a constraint to development of the industry but, due to the solution of power generators in office buildings, the insufficient electricity is not seen by the company as a constraint in the performance of work. The frequent power failures can have a negative impact on the development of the domestic IT and software market though, because it constrains the spread of information technology among the public. (Frankel & Sen 2005:23). Even though the work performed in the IT sector does not require an overall functioning infrastructure it is important in the attraction of FDI, where infrastructure is a factor considered by the investors while choosing a location. To facilitate and overcome infrastructural problems, small centres with apartments, hotels and service facilities are created around companies located outside the city centre. (various interviews).

Limitations for a development of the domestic IT market and the spread of computers are also; low literacy rate, several official languages and a lack of English knowledge among the main part of the population. The low literacy rate and the absence of English knowledge complicate the use of existing hardware and software, which use English as the medium of construction. The large number of languages and the low literacy rate in India reduce the incentives for companies to develop software compatible with the different demands of the Indian market.

The long distances to the major IT export markets are a limitation for the development of the Indian IT market because they complicate face-to-face interactions. D'Costa 2004, acknowledges the importance of face-to-face interactions and also the importance of market proximity for innovations and technology development of software. Because of India's export orientation in software and the relatively small domestic IT market, the country is dependent on external clients and their demands. The great distance to foreign markets is an obstacle to face-to-face interactions between Indian producers and foreign consumers. The restricted numbers of interactions and limited knowledge about the customers requirements in software products and services lead to difficulties in meeting the demand of foreign clients and increase the risk of misunderstanding.

Which position the Indian companies have in the value chain and the importance of climbing the value chain for a continued growth of the IT sector are being discussed. One opinion is that a low position in the value chain is a constraint for a further development while

others argue that the position in the value chain is irrelevant, and it is more important to focus and specialize in the production where the company has the highest productivity. According to D'Costa (2004), India is currently locked into the lower end of the value chain. He explains this with path dependency, where institutions, politics and historical events in the past influence the development of technology in the future. The path dependency obstructs the break out from the low-end trajectory into a development of high-technology products. He also means that export can lead to a dependency, through a too large focus on the demand of foreign customers and a decreased allocation of resources to innovation. Most Indian companies in the software sector are maximizing absolute revenue and not revenue per employee which results in a capturing of every project, irrespective if the work is low-end or high-end. According to D'Costa it will be difficult for the Indian IT industry to reach a high growth if the companies do not climb the value chain. (D'Costa 2004:52ff).

In recent years the Indian software firms have climbed the value chain and, according to a statistical survey about low- and high-end work in the Indian IT sector by Abraham and Joseph (2005), there has been a decrease in the specialisation of both low- and high-end work. Instead, the present technological strategy for Indian software companies is to diversify the production between low- middle- and high-end work. (Abraham & Joseph 2005:142).

## 6 Conclusion

The Indian IT industry is a relatively new industry which has had a high economic growth during the last 15 years. It is interesting that a high technology industry such as IT, which often is associated with developed countries, has succeeded in a developing country. India's specialisation in the IT industry, can through economic theories, be explained by the possibility of trade and the exploitation of comparative advantages together with created comparative advantages through implementation of industry policies. The economic theories of international specialisation and comparative advantages, foreign direct investment and industrial policies are used to analyse the factors affecting the specialisation of the IT industry. Often stated is that India's advantage in IT consists of low labour costs, but this study shows that there are more factors that have been important for the development of the sector. Besides the comparative advantage of a large skilled workforce which is shown in low labour costs relative to other countries, comparative advantages have been created through a knowledge of English, liberalisation of the economy, directed industrial policies, foreign direct investment and a creation of a reputation.

According to the Heckscher-Ohlin theory, a comparative advantage in high skilled labour intensive work shown in terms of low labour cost could be explained by a relative large endowment of skilled labour in relation to capital within and across countries, which can result in a production of labour intensive goods and a specialisation in a sector using the abundant factor labour most intensively. The IT sector is characterised by a high skilled labour intensive production and India has therefore a comparative advantage in the production of IT products and services. During the last years the wages have increased, but India has retained its comparative advantage in low labour cost with an increased productivity and quality of the products and services. According to the Ricardo theory, India's comparative advantage in IT production could be explained by the high productivity level in the sector which is close to the global technology level compared to the productivity in other sectors in the Indian economy. The IT sector is dependent on high skilled labour and a functioning telecommunication sector and less dependent on other sectors in the economy, which makes the IT industry suitable for India with a poor infrastructure.

During the development of its IT industry India already had a pool of high skilled engineers available to start working in the sector because of the Indian society's and the government's traditional focus on education in mathematics and science which facilitated a

direct growth of the industry. The government's focus and promotion of education can be seen as industry policies directed towards the education system, resulting in created comparative advantages in skilled work.

The economic reforms in the beginning of the 1990s shifted India's development strategy from import substitution to export orientation, liberalised the economy, created a more favourable climate for trade in terms of lower tariffs and deregulations of the economy and made India more attractive for foreign investors. A more competitive climate was created, which increased the efficiency in the industry. An increased export and export orientation of the sector were made possible by the economic reforms. The reforms led to an allowance of 100 per cent FDI in the software industry which resulted in increased investments by foreigners in the IT industry in order to exploit India's comparative advantages in the production of IT. The presence of foreign companies has led to positive spillover effects such as new technology and knowledge and increased competition to the domestic companies. During the same time as the economic reforms, the government implemented industry policies directed towards the IT industry in order to create comparative advantages. One industry policy is the STPIs, incorporating for example, zero tax on export incomes though the export must exceed a certain amount, and no tariffs on import of goods used within the company and which should create a beneficial climate for the companies in the IT industry. To promote the sector both domestically and internationally, and to create a relation between the political institutions and the industry, the trade body NASSCOM has been established.

The fast growth of the global IT industry in 2000 resulted in the fact that the demand for IT engineers in the developed countries exceeded the supply and increased the demand for the Indian English speaking engineers and gave them an opportunity to meet the demand and show their skills. The theory of Vinayak Banerjee states that a country's possibility to exploit the comparative advantages depends on the country's reputation in the global market. The promotion of the IT industry by NASSCOM together with the use of quality certificates, the establishment of networks and the possibility to show the skills of the industry have improved the information and the reputation of the Indian IT industry. The reputation has made it easier for India to overcome the "country of origin" risk, that products from a developing country suffer from, and exploit the comparative advantage in IT and increased exports.

The Indian IT sector has had a successful development and is forecasted a continued high growth by NASSCOM. However there are obstacles to a continued high growth, in terms of undeveloped infrastructure and a future shortage of skilled engineers if the number of graduates does not increase at the same rate as the industry expands. If the high growth of the

sector continues, the industry can have a positive impact on other sectors and act as a catalyst for the development of the Indian economy. Spillover effects from the IT sector to other sectors in the economy can be seen in terms of higher spending in retail, real estate and services. The effect of IT industry on other sectors is an interesting subject for further studies as is elaborating how an implementation of IT in the society can impact growth and development of the economy.

## 7 References

- Abraham, Vinoj & Joseph, K.J. (2005) “Moving Up or Lagging Behind? An Index of Technological Competence in India’s ICT sector”. Saith, Ashwani & Vijayabaskar, M. (eds.) *ICTs and Indian Economic Development, Economy, Work, Regulation*, p. 131-153. Sage Publications India Pvt Ltd, New Delhi.
- Ahluwalia, Montek S. (2002) “Economic reforms in India since 1991: Has gradualism worked?”. *Journal of economic perspectives*, No. 1, Vol. 16, 2002, p. 67-88.
- Arora, Ashish & Arunachalam, V.S. & Asundi, Jai & Fernandes, Ronald (2001) “The Indian software services industry”. *Research policy*, No. 8, Vol. 30, 2001, p. 1267-1287.
- Arora, Ashish & Athreye, Suma (2002) “The software industry and India’s economic development”. *Information Economics and Policy*, Vol. 14, 2002, p. 253-273.
- Athreye, Suma S. (2005) “Human Capital, Labour Scarcity and Development of the Software Services Sector”. Saith, Ashwani & Vijayabaskar, M. (eds.) *ICTs and Indian Economic Development, Economy, Work, Regulation*, p. 154-174. Sage Publications India Pvt Ltd, New Delhi.
- Bajpai, Nirupam (2002) “A Decade of Economic Reforms in India: the Unfinished Agenda” Working Paper No. 89, 2002, Center for International Development at Harvard University.
- Bajpai, Nirupam & Shastri, Vanita (1998) “Software industry in India: A case study”. Development discussion papers No. 667, 1998, Harvard Institute for International Development.
- Banerjee, Abhihit & Duflo, Esther (2000) “Reputation Effects and the Limits of Contracting” *Quarterly Journal of Economics*, August 2000, p.989-1017.
- Beine, Michel & Docquier, Frédéric & Rapoport, Hillel (2001) “Brain drain and economic growth, theory and evidence” *Journal of development economics*, Vol 64, 2001, p. 275-289.
- Blomström, Magnus & Kokko, Ari (1997) “The impact of foreign investment on host countries: A review of the empirical evidence”. World bank policy research working paper No. 1745, Stockholm school of economics.
- Blomström, Magnus & Kokko, Ari (1998) “Multinational Corporations and spillovers”. *Journal of economic surveys*, No. 3, Vol 12, 1998, p. 247-77.



- D'Costa, Anthony P. (2004) "Export growth and path-dependence: the locking-in of innovations in the software industry". D'Costa Anthony P & Sridharan E. (eds.) *India in the global software industry innovation, firm strategies and development*, p. 51-82 Palgrave Macmillan, New York.
- Frankel, Francine & Sen, Sumantra (2005) "India's strategy of IT-led growth: Challenges of asymmetric dependence". *India in Transition economics and politics of change*, 2005, p. 1-33. Center for the advanced studies of India and the trustees of the University of Pennsylvania, Philadelphia.
- Greenaway, David & Görg, Holger (2003) "Much ado about nothing? Do domestic firms really benefit from foreign direct investment?". Discussion paper No. 3485, 2003, Centre for economic policy research, The institute for the study of labor, Bonn.
- Harikumar, S. (2006) "Banking sector reforms and performance". Rajan, K. (eds.) *Indian Economy, the post reform scenario*, p. 278-288. Serials publications, New Delhi.
- Hausmann, Ricardo & Rodrik, Dani (2006) "Doomed to choose: industrial policy as predicament" Harvard University.
- Heeks, Richards (1996) *India's software industry state policy, liberalisation and industrial development*. Sage Publications India Pvt Ltd, New Delhi.
- Joseph, K.J. & Parthasarathi, Ashok (2004) "Innovation under export orientation". D'Costa, Anthony P. & Sridharan E. (eds.) *India in the global software industry innovation, firm strategies and development*, p. 83-111 Palgrave Macmillan, New York.
- Kaempfer, William H. & Markusen, James R. & Maskus, Keith E. & Melvin, James R. (1995) *International trade theory and evidence*. McGraw-Hill Inc, Singapore.
- Krugman, Paul & Venables, Anthony J. (1995) "Globalisation and the inequality of nations". *The quarterly journal of economics*, No. 4, Vol. 110, 1995, p. 857-880. MIT press.
- Kumar, Mohan P.S. (2006) "Economic reforms, GATS and higher education". Rajan, K. (eds.) *Indian Economy, the post reform scenario*, p.323-335. Serials publications, New Delhi.
- Kumar, Nagesh (2005) "Indian Software Industry Development: National and International Perspectives". Saith, Ashwani & Vijayabaskar, M. (eds.) *ICTs and*

*Indian Economic Development, Economy, Work, Regulation*, p. 93-130. Sage Publications India Pvt Ltd, New Delhi.

- Lall, Marie (2005) “The challenges for India’s education system”. Briefing paper Asia programme, Chatham House.
- Mani, Sunil (2005) “Innovation capability in India’s telecommunications equipment industry”. Saith, Ashwani & Vijayabaskar, M. (eds.) *ICTs and Indian Economic Development, Economy, Work, Regulation*, p. 265-325. Sage Publications India Pvt Ltd, New Delhi.
- Mukherji, Sourav & Ramachandran J (2004) “Complementary and continuous innovation: case of the Indian software industry”. *Journal of Academy of Business and Economics*, No. 1, Vol. 4, 2004, p. 211-215.
- Murthy, Narayana N.R. (2004) “The impact of Economic reforms on industry in India: A case study of the Software Industry”. Basu, Kaushik (eds.) *India’s emerging economy*, p. 217-222. Oxford University Press, New Delhi.
- NASSCOM (2006) *Strategic review 2006: The IT industry in India*. New Delhi.
- NASSCOM-McKinsey (2005) *NASSCOM-McKinsey report 2005*. New Delhi.
- NASSCOM (2005) folder *Information Technology in the economy of India*. New Delhi.
- Ramachandran, J (2006) “Indian software industry the growth saga continues” Indian institute of management Bangalore
- Ray, Debraj (1998) *Development economics*. Princeton University Press, New Jersey.
- Sathish V.R. (2006) “Information technology and economic development of India” Rajan, K. (eds.) *Indian Economy, the post reform scenario*, p. 222-258. Serials publications, New Delhi.
- Singh, Nirvikar (2004) “Information technology and India’s economic development” Basu, Kaushik (eds.) *India’s emerging economy*, p. 223-261 Oxford University Press, New Delhi.
- Smith, Stephen C. & Todaro, Michael P. (2006) *Economic Development*. Pearson Education Limited, Essex. 9<sup>th</sup> ed.
- Sridharan E. (2004) “Evolving toward innovation? The recent evolution and future trajectory of the Indian software industry”. D’Costa, Anthony P. & Sridharan E. (eds.) *India in the global software industry innovation, firm strategies and development*, p. 27-50 Palgrave Macmillan New York.

- Vinayaka Banerjee, Abhijit (2006) “Globalization and all that” Vinayaka Banerjee, Abhijit & Bénabou Roland & Mookherjee Dilip (eds.) *Understanding poverty*, p. 85-98 Oxford University Press.
- World Bank Group, Multilateral investment guarantee agency with the assistance of Deloitte & Touch LLP (2002) “Foreign Direct Investment Survey”. 2002-01-01 Washington.

### **Internet sources**

- NASA obtained, 17-11-06.  
[[www.grc.nasa.gov/WWW/Purchase/Section\\_508\\_def.htm](http://www.grc.nasa.gov/WWW/Purchase/Section_508_def.htm)]
- NASSCOM obtained, 07-11-06.  
[<http://www.nasscom.in/Nasscom/templates/NormalPage.aspx?id=5365>]
- NASSCOM obtained, 14-12-06.  
[<http://www.nasscom.in/upload/5216/NASSCOM%20Knowledge%20Professionals%20Factsheet%202006.doc>]
- Suranovic, M. Steven obtained, 27-11-06.  
[<http://internationalecon.com/v1.0/ch40/40c000.html>]

### **Interviews**

- Agervi, Mats. IBM, 19-09-06.
- Bhattacharjee, Priya. Federation of Indian Chambers of Commerce and Industry, 04-09-06.
- Chakravorty, Tamal. Ericsson, 06-09-06.
- Chakravarty, Sujoy. Indian Institute of Technology, Delhi, 01-09-06.
- Diez, Alberto. Brandsystem, 14-09-06.
- Fexe, Fredrik. Swedish Trade Council, Delhi, 07-09-06.
- Gandhi, Kishore. Rajiv Gandhi institute of technology and management education, 08-09-06.
- Gosh, Sunny. Digimaker, 19-09-06.

- Gurbaxani, Prakash. TSI Ventures, 18-09-06.
- Johansson, Bengt. Swedish Trade Council, Bangalore, 14-09-06.
- Khan, Amir Ullah. PHD Chamber of Commerce and Industry, 04-09-06.
- Khanna, Mohan. NASSCOM, Delhi, 31-08-06.
- Kumar, Deepak. Euseden Consulting, 22-09-06.
- Lindorff, Jesper. Continuum Systems, 06-09-06.
- Mani, R.S. & DR. Vijayaditya, N. & Misra, D.C. National Informatics Centre, 28-08-06.
- Manzar, Osama. Digital empowerment foundation, 28-08-06.
- Malhotra, Usha. Ex Member of Parliament, 08-09-06.
- Mukherji, Sourav. India Institute of Management, Bangalore, 25-09-06.
- Narasipur, Sreehari. Telelogic, 18-09-06.
- Naveen. NASSCOM. Bangalore, 21-09-06.
- Oberger, Bengt. SIDA (Swedish international development cooperation agency), New Delhi, 12-09-06.
- Ramaswamy, V. Transworld solutins private limited, 25-09-06.
- Samuel, Sophia. Wipro, 20-09-06.
- Sawjani, Aashid. European Business Group, 09-09-06.
- Seth, Sanjay. TATA Consulting Services, 11-09-06.
- Shah, Kalpana. Journalist, 15-09-06.
- Srinivasan, N. United Nations Asian & Pasific centre for transfer of technology, 01-09-06.

# Appendix

## Appendix 1 Indian IT-ITES service exports by destination

USD Million	2002-2003		2003-2004		2004-2005	
	Share (%)	Value	Share (%)	Value	Share (%)	Value
<b>Americas</b>	<b>69.1</b>	<b>6,590</b>	<b>69.4</b>	<b>8,884</b>	<b>68.4</b>	<b>12,107</b>
Brazil	0.01	1	0.1	1	NA	NA
Canada	1.1	101	1.1	143	0.9	159
Mexico	0.01	1	0.01	1	NA	NA
USA	67.7	6,464	68.2	8,725	66.5	11,769
Rest of America	0.2	24	0.1	13	1.0	178
<b>Asia &amp; Middle-East</b>	<b>7.9</b>	<b>757</b>	<b>7.4</b>	<b>943</b>	<b>8.0</b>	<b>1,416</b>
Australia	0.8	76	0.8	105	0.8	139
China	0.1	10	0.1	15	0.1	24
Hong Kong	0.2	19	0.2	26	NA	NA
Japan	2.8	269	3.0	385	2.8	500
Singapore	1.7	166	1.8	227	1.7	300
South Korea	0.2	16	0.2	23	0.0	7
Rest of Asia	2.1	201	1.3	161	2.6	460
<b>Europe</b>	<b>22.2</b>	<b>2,123</b>	<b>22.6</b>	<b>2,894</b>	<b>23.1</b>	<b>4,093</b>
UK	14.0	1,336	14.5	1,857	14.0	2,478
Germany	2.6	248	2.8	354	2.3	400
France	0.5	46	0.5	65	0.4	72
Italy	0.1	9	0.1	12	NA	NA
Finland	0.4	40	0.5	61	NA	NA
Sweden	0.5	51	0.6	76	0.6	100
Netherlands	1.1	101	1.0	129	1.4	250
Switzerland	0.7	64	0.7	91	0.7	120
Rest of Europe	3.2	302	2.5	330	4.3	763
<b>Grand Total</b>	<b>100.0</b>	<b>9,544</b>	<b>100.0</b>	<b>12,800</b>	<b>100.0</b>	<b>17,705</b>

Source: NASSCOM 2006:49