CHAPTER ONE
INDIAN ELECTRONICS INDUSTRY UNDER ECONOMIC LIBERALISATION

1.1 Introduction

During the pre-reform period, India has followed a state-controlled and inward-looking strategy of industrial development. Through licensing policy government has controlled investment activities of private sectors both Indian domestic and foreign firms. Its objective was to protect domestic industry against foreign competition. It also restricted import of technology, capital, raw material, machinery etc., with a view to strengthen domestic technology. However, this has resulted production of poor quality at high cost and selling products at higher price than the competitive market. This has reduced the incentives to production and export and resulted inefficiency with sluggish growth. During this period, controls were rigid, which caused delays and uncertainties. The licensing policies curtailed competition by creating entry barriers. The import substitution policies discouraged specialization and encouraged diversification. The absence of import competition resulted less invention and innovation activities and produce outdated products with the help of out dated technology.

This inefficient performance of Indian industry drawn attention of prevailing rigid industrial policies and reform has been initiated during 1980’s. In this process important changes have been made in licensing, foreign investment, technology import etc., However, inward looking policy still was existing through using rigid import policy in favour of Indian trade, raising tariff and removing items from open general license (OGL)\(^1\) to the restrictive list. Hence during the year 1991, major reform has been introduced by emphasizing trade policies by import liberalization and removing barriers to exports. The reform policies have reduced government controls on production capacity, import of capital goods, intermediate goods etc. The growth of large firms was encouraged and MRTP\(^2\) act was reduced and limited only

\(^{1}\) The items that are listed in Open General License (OGL) policy, can be imported without a license.

\(^{2}\) MRTP (Monopolistic and Restrictive Trade Practices) Act, was enacted in 1969. To ensure that the operation of the economic system does not result in the concentration of economic power in hands of few, to provide for the control of monopolies, and to prohibit monopolistic and restrictive trade practices.
to regulate unfair trade practices. Technology import was liberalized and foreign equity raised above fifty per cent in high priority areas.

Electronics industry occupies an important place in the economy. As a key industry, it links every sector and facilitates to the growth of the economy. As a sunrise (electronics) industry, the extent and impact of liberalization is more ahead than other industries. Integrating Indian electronics industry with MNE’s resulted with several challenges as well as new opportunities. It is challenges because of entry of foreign firms with import of foreign capital and also new opportunities arose from the opening up of the world markets for the Indian electronics industry.

However, if the Indian Electronics industry has to exploit its inherent strengths and emerge as a global player it has to strengthen the determinants of the electronics industry. With most global brand names setting shop in India, and the duty differentials slated to vanish soon, the status of the computer hardware industry in India may soon be reduced to an efficient screwdriver operator unless urgent steps are initiated for its reorientation (Naik, 2001). To strengthen electronics hardware industry, government policies are to be more liberal and it has to be altered according to the policies of competitors (countries).

The Electronics industry is characterised by short product life cycles, falling prices, high obsolescence costs and rapid changes in technology. Import of electronics goods at cheaper price, may affect our domestic firms. As the price of electronics goods is falling, domestic demand for the electronics goods have been rising. India cannot afford to depend on imports entirely to meet its domestic requirement. To be self sufficient the electronics industry requires a strong hardware base with adequate capital and advanced technology. To strengthen this industry, domestic technology may not be sufficient and to fill the technology gap import of technology is very essential.

The immediate effect of the policy changes was a rapid increase in the number of firms in the industry. Initial reform, during 1980’s encouraged domestic electronics firms. Further liberalisation of the industry led to an increase number of foreign firms. With the result, our indigenous industry got exposed to the aggressive competition of multinational companies. Many of the small firms are closed, as they do not have economies of scale. Thus, main suppliers would remain as multinationals and large Indian companies. Most of the foreign firms preferred not to compete but
to collaborate with the Indian firms. It is essential for Indian companies to have a good foreign partner at least in the beginning. The main objectives of Indian companies in this regard to support their investment in research and development, access the latest technologies and also fulfil the feelings that foreign technology is invariably superior to their domestic equipments. As regards the foreign partners, their motivations are to take advantage of the growing Indian market as well as the low production costs in the country. In this process, many of the Indian companies were subsequently taken over by foreign companies. This has resulted in a reduction of the number of domestic firms; in other words it has increased the number of Indian collaborations and foreign firms.

The key factors that are determining the strength of the electronics industry are the skilled manpower, investment on research and development, profit, foreign equity participation, existence of multinational companies, policy support, technology import, export, etc. Along with these factors, the existence of research and development institutions, public sector and science and technology institutions have helped develop the electronics industry in India. India has the distinction of being the destination for a large number of multinational companies in knowledge-based industries and technology-driven sectors and is today recognized for economies of scale in the world.

The basic aim of this study is to analyse the Structure, Performance and growth of India's electronics industry under economic liberalization. It will attempt to look at the Total and Partial Productivity and the export performance and the determinants. It will attempt to study the Ownership pattern and its implication on electronics industry. It will analyse linkages between growth performance of electronics industry with the research and development investment. This will also attempt to study the employment level of the electronics industry.
1.2 Objectives of the Study

1. To study the impact of Economic reform on Electronics industry.
2. To examine changes in total and partial factor productivity in electronics industry
3. To study the employment behaviour in electronics industry.
4. To analyse the bearing of ownership pattern on export behaviour in electronics industry.
5. To analyse the bearing of ownership pattern on research and development behaviour in electronics industry.

1.3 Hypothesis

1. The rate of profit is positively related to the degree of market concentration and influenced by conduct variables.
2. Liberalization through increased competition, has had a positive impact on productivity growth in electronics industry.
3. The output growth spurs employment growth but, elasticity of employment would be less than one.
4. The larger is the presence of foreign firms, faster is the growth of domestic firms and the export of electronics industry.
1.4 Methodology

Objective 1

Structure and Performance

To study the performance and determinants of performance of electronics industry for the period of pre and post reform period, structure-conduct-performance (S-C-P) paradigm has been used. The structure-conduct-performance (S-C-P) paradigm explains the performance of firm/industry consequent upon the changes in market structure. It hypothesizes that the degree of market concentration is inversely related to the degree of competition and positively related to profit. In this model, the main causality moves from industry structure (concentration ratio) variable to firm conduct variables (strategy) and then performance (profit) variable. Here, the performance of a firm/industry measured in terms of price-cost margin, the structure is measured in terms of the concentration ratio or the Herfindal index and the conduct (behavior) is usually seen in competitive strategies like capital intensity, export intensity, firm size, R&D, age, import technology, capital import intensity, excise duty, advertisement, liberalization dummy and foreign dummy.

Measurement of S-C-P paradigm

\[ PRI - COS = \alpha + \beta_1 SH + \beta_2 EXP + \beta_3 ADV + \beta_4 FIR\_SIZ + \beta_5 RD + \beta_6 AGE + \beta_7 MT + \beta_9 CMI + \beta_{10} CED + \beta_{12} CI + \beta_{11} LIB\_D + \beta_{12} FOR\_D. \]

\[ PRI = \text{Price} \quad \text{COS} = \text{Cost} \]

\[ PR = PRI - COS = \text{Performance: performance of firms in terms of their price-cost margin}^3 \]

Structure (SH): structure of market is represented by largest three firms share in total industry sales.

Conduct: behavior of firms – The conduct variables represents competitive strategies of the firms. Conduct variables are capital intensity, export intensity, firm size, R&D, age, import technology, capital import intensity, excise duty, advertisement, liberalization dummy and foreign dummy.

---

3 Price - cost margin is defined as follows: \( PR = (TR - TC) / TR \) where \( TR = \text{Total revenue}, \ TC = \text{Total cost} \).
To measure market concentration either concentration ratio or Herfindahl index has been used:

The Concentration ratio (Herfindahl Index)

\[ H = \sum_{i=1}^{n} s_i^2 \]

where \( s_i \) is the market share of firm \( i \) in the market, and \( n \) is the number of firms. The Herfindahl Index \( (H) \) ranges from \( 1/N \) to one, where \( N \) is the number of firms in the market.

There is also a normalised Herfindahl index. Whereas the Herfindahl index ranges from \( 1/N \) to one, the normalized Herfindahl index ranges from 0 to 1. It is computed as:

\[ H^* = \frac{(H - 1/N)}{1 - 1/N} \]

where again, \( N \) is the number of firms in the market, and \( H \) is the usual Herfindahl Index, as above.

Price cost margin, Wage share and Central Excise duty

Price Cost Margin = \([\text{Value of Output} - (\text{Salary and Wages} + \text{Expenditures on Materials} + \text{Expenditure on Power})]/\text{Value of Output}\)

Objective 2

Productivity

To assess the productivity in electronics industry, production function has been used.

The production function explains the combination of inputs to obtain a given level of output or to maximize output for a given level of inputs. The total factor productivity growth is as important as the factor input growth. The productivity measurement explains technology, efficiency, living standards etc. Technological change (dis-embodied form or embodied form) helps to convert inputs into output as desired by the economy. Technology and fixed amount of inputs maximizes output in other words increases efficiency. Among the various inputs, labour is the major contribution for the efficiency gains.
Productivity is nothing but residual, which is explained by technology change, efficiency, capacity utilization, learning by doing and measurement errors. It also measures living standard.

Capital productivity explains how capital is used to generate output. It reflects the joint influence of labour, intermediate inputs, productivity etc. Similarly, the Labour productivity reflects how output is generated with given labour input. However, partial factor productivity does not reflect a change in the individual characteristics of the labour, technology or efficiency. Multi Factor Productivity measures are required for this purpose. In KLEM multifactor productivity analysis quantity index of combined inputs are calculated by index of labour, capital, energy and material each weighted with its current-price share in total gross output. It explains disembodied technical change. In other words, it reflects efficiency change, economies of scale, variations in capacity utilization and measurement errors.

The Growth accounting technique explains how much of an observed rate of change of an industry’s output can be explained by the rate of change of combined inputs. It is based on following assumption viz., production functions relate maximum producible output to sets of available inputs, producers behave efficiently, markets are competitive etc. Econometric approach, helps to investigate technical change other than the Hicks-neutral formulation implied by the index number based approach, and there is no a prior requirement to assume constant returns to scale of production function.

**Growth Accounting Approach**

**Translog Index of Total Factor Productivity**

The translog index of Total Factor Productivity (TFP) is a discrete approximation to the divisia index of technical change. It has the advantage that it does not make rigid assumptions about elasticity of substitution between factors of production (as for instance done by the Solow index). It allows for variable elasticity of substitution. Another advantage of the translog index is that it does not require technological progress to be Hicks-neutral. The translog index provides an estimate of the shift of the production function even if technological change is non-neutral. For the two-input case, taking value added as output and labour and capital as inputs, the translog index of TFP growth is given by the following equation.
\[ SL(t) + SL(t-1) \quad SK(t) + SK(t-1) \]
\[ \Delta \ln TFP(t) = \Delta \ln Y(t) - \left[ -\frac{\Delta \ln L(t)}{2} \right] - \left[ -\frac{\Delta \ln K(t)}{2} \right] \]

In the above equation, \( Y \) is output, \( L \) labour and \( K \) capital. \( SL \) is income share of labour and \( SK \) denotes income share of capital. Change \( \ln Y(t) = \ln Y(t) - \ln Y(t-1) \). In the same way, Change \( \ln L(t) \), and Change \( \ln K(t) \) are defined. \( SK \) and \( SL \) add up to unity. Change \( \ln TFP \) is the rate of technological change or the rate of growth of TFP. Change \( \ln TFP \) is the rate of technological change or the rate of growth of TFP (Goldar 2004).

**Multilateral TFP index**

The formula for the multifactor productivity index when there are four factors of production: Capital (K), Labour (L), Energy (E) and Materials (M).

Let \( SL_b \) be the income share of labour in the firm-year \( b \) and \( \bar{SL} \) be the arithmetic mean of income share of labour across all observations. Then \( \alpha_b \) can be written as:

\[ \alpha_b = \frac{SL_b + \bar{SL}}{2} \]

Similarly, \( \alpha_c, \beta_c, \gamma_c, \lambda_c, \beta_b, \gamma_b \) and \( \lambda_b \) are defined.

Now, \( TFP_{bc} = \)

\[ \left( \frac{Y_b}{Y_c} \right)^{\alpha_b} \left( \frac{L}{K_b} \right)^{\beta_b} \left( \frac{E}{E_b} \right)^{\gamma_b} \left( \frac{M}{M_b} \right)^{\lambda_b} \]

Where \( Y = \) Output

\( K = \) Capital

\( L = \) Labour input

\( E = \) Energy or Fuel input

\( M = \) Material input
This index expresses the productivity level in firm-year b (say, Firm x in year 2004-05) as a ratio of the productivity level in firm-year c (say, firm y in year 2000). L, K, E, and M with a bar above are sample averages (geometric means). The coefficients represent respective income shares.

Econometric Estimation of Productivity

Cobb Douglas Production function

In the econometric method of production function, the coefficient of \('t'\) gives total factor productivity growth. Here, the Cobb-Douglas production function (CD) has been used, to estimate total factor productivity growth.

Objective 3

Employment

Electronics industry generates the maximum employment per unit of investment not only for semi skilled labour on the assembling floors but also for professionals in design and development\(^4\). Since India's electronics manufacturing involves assembling of components, it is possible that the employment generation capacity may come down with technological change. However, India has all the advantages as East and East Asian Countries have and cost of production is cheaper than many of these countries. Existence of SEZ, EPZ and IT parks attracts MNE’s to participate either through equity shares or establish their own firms. This may results to increase in production, export and employment.

Specification of the Model

Reviews of literatures pertaining to employment function, theories related to employment and discussion of hypotheses with regard to employment help us in constructing the model of employment. Here, employment behaviour has been studied at the industry as well as the firm level. At the industry level, the employment behaviour has been studied by looking at the growth of labour and change in growth of labour. At firm level both dependent and independent variables

\[ \alpha_b, \alpha_c, \beta_c, \gamma_c, \lambda_c, \beta_b, \gamma_b, \text{and} \ \lambda_b \] are weights based on income shares.

have converted into log values (except 'owner') and employment behaviour is estimated.

The Econometric model of employment behaviour at firm level is as follows:

$$\ln \text{Emp} = f(\ln \text{Output}, \ln \text{Tfp}, \ln \text{Skill} \_\text{Int}, \ln \text{Imp} \_\text{Int}, \text{Owner})$$

Ln Emp is log Employees,
Ln Output is log Output,
Ln Tfp is log Total factor productivity,
Ln Skill\_Int is log of Emolument/Wage
Ln Imp\_Int is log of Import per unit of Output,
Owner = Public and Private sector.

Above estimation of employment function (model) is panel data analysis, based on ASI unit level data. The study period consists of 1993-94 to 2004-05. Here it is classified as the beginning of the reform period (1993-94 through 1998-99) and latter part of the reform period (1999-00 through 2004-05)\(^5\). The Stata package has been used to estimate employment behaviour. Generalised Least Square and Ordinary Least Square methods have been used for the estimation.

The Econometric model of employment behaviour at industry level is as follows:

$$gL = f(gW, gM, gQ, )$$

gL is Growth in employment,
gW is Growth in real wages,
gM is Growth in Man-days per employee,
gQ is Growth of output,

The above models have been based on the pooled cross section data at ASI 3-digit level. Here, growth of labour has been assumed to be a function of growth of real wages, growth of man-days per employee, growth of output and growth of wage-rental ratio. In another model, the employment behaviour has been estimated with the

\(^5\) The study time period has been divided into two, and separate panels have been made for 1993-94 to 1998-99 for the 1990s and 1999-00 through 2004-05 for the 2000s. During the 1990s panel construction was made on the basis of Permanent Serial Number and the State code. The PSN is unique to the state. From 1998 onwards firm identity has been suppressed leading to more problems in making the panel. However, firms have been identified through the available information, viz., NIC code, state code, Year of establishment and Organisation code.
change in above variables (growth of labour, growth of real wages, growth of man-days per employee and growth of output).

To analyse econometrically the relationship between employment growth rate and the growth rates of wages, man-days per employee, output and wage-rental ratio, some regression equations have been estimated. Growth rate in employment (gL) has been regressed on growth rates in real wages (gW), man-days per employee (gM), and output (gQ). The variable ‘Con’ is the constant. The regression analysis has been done separately for the period 1980-81 to 1990-91 and 1990-91 to 1997-98. The estimated equations are shown in the table (t-ratios in parentheses):

This will provoke to Study the employment generation capacity of Electronics industry.

K/L and L/O Ratio

K/L = Capital Labour ratio
L/O = No. of persons employed to produce Rs. Lakh of output.

Employment elasticity

\[ \ln \text{Emp} = \alpha + \beta_2 \ln Q \]

Emp = Employment
Q = Output

One attractive feature of the log model, which has made it popular in applied work, is that the slope coefficient \( \beta_2 \) measures the elasticity of Y with respect to X, that is, the percentage change in Y for a given (small) percentage change in X. Here \( \beta_2 \) measures employment elasticity.\(^6\)

Objective 4.

Ownership pattern - Export Behaviour

Electronics industry can be broadly classified by ownership as domestic (public & private) sector and foreign sectors. During pre-reform period Indian domestic sector, particularly public sector was dominating. Liberalization of economy increased domestic private participation and further liberalisation encouraged foreign firms

\(^6\) The elasticity coefficient, in calculus notation, is defined as \( \frac{dY/Y}{dX/X} = \frac{dY/dX}{X/Y} \). \( \beta_2 \) in fact the elasticity coefficient. - Basic Econometrics by Damodar N Gujarati, Tata McGraw-Hill edition.
participation either through equity participation or by establishing their own firms in India. Ownership pattern has been studied by Export behaviour and R&D behaviour.

Owner pattern is studied by following method:

**Specification of the model**

Export intensity = \( f(\text{Capital intensity}, \text{Firm size}, \text{Capital import intensity}, \text{Age of firm}, \text{Import of technology}, \text{Research and Development}, \text{Central excise duty}, \text{Advertisement intensity}, \text{Intermediate import intensity}, \text{Vertical integration}, \text{Liquidity ratio}, \text{Liberalisation dummy}, \text{Foreign dummy}) \)

\[
\text{EXP} = \alpha + \beta_1 \text{CI} + \beta_2 \text{FIR}\_\text{SIZ} + \beta_3 \text{CMI} + \beta_4 \text{AGE} + \beta_5 \text{MT} + \beta_6 \text{RD} + \beta_7 \text{CED} + \beta_8 \text{ADV} + \beta_9 \text{MMI} + \beta_7 \text{VER}\_\text{INT} + \beta_8 \text{LIQ}\_\text{R} + \beta_9 \text{LIB} \_\text{D} + \beta_{10} \text{FORN} \_\text{D}
\]

**Objective 5.**

**Ownership pattern - Research and Development Behaviour**

R&D intensity has positive relation between firm size and technology imports (Lall et. al. 1983). Invention and innovation is the driving force for the growth and development of electronics industry. Import of technology fills technology gap, the domestic research and development and technology import plays major role for technology progress in India. The importance of technology by ownership can be examined by following method.

**Specification of the model**

Research and Development = \( f(\text{Capital intensity}, \text{Firm size}, \text{Capital import intensity}, \text{Age of firm}, \text{Import of technology}, \text{Export intensity}, \text{Central excise duty}, \text{Advertisement intensity}, \text{Intermediate import intensity}, \text{Vertical integration}, \text{Liquidity ratio}, \text{Liberalisation dummy}, \text{Foreign dummy}) \)

\[
\text{R&D} = \alpha + \beta_1 \text{CI} + \beta_2 \text{FIR}\_\text{SIZ} + \beta_3 \text{CMI} + \beta_4 \text{AGE} + \beta_5 \text{MT} + \beta_6 \text{EXP} + \beta_7 \text{CED} + \beta_8 \text{ADV} + \beta_9 \text{MMI} + \beta_7 \text{VER}\_\text{INT} + \beta_8 \text{LIQ}\_\text{R} + \beta_9 \text{LIB} \_\text{D} + \beta_{10} \text{FORN} \_\text{D}
\]

Technology acquisition in Aggregate, Public and Private Companies

Technology acquisition in Central Govt., State Govt., Foreign Private and Indian Private sector

---

7 Econometrics of Indian Industry-Bishwanath Goldar
1.5 Data Base

Output and Inputs Measurement of ASI three digit data

To estimate Productivity and measure Output and input, data have been drawn mainly from the Annual Survey Industries (ASI), published by the Central Statistical Organisation (CSO), government of India. The Economic and Political Weekly has created a systematic, electronic database using ASI results for the period 1973-74 to 2003-04 (hereafter, EPW database). Data have been drawn on the following variables: gross output, net value added, employment, total emoluments of employees, fixed capital stock, depreciation and value of intermediate inputs.

Net fixed capital stock at constant prices has been taken as the measure of capital input. The construction of the net fixed capital stock series has been done by the Perpetual Inventory method. The steps in the construction of fixed capital series are as follows. (1) Implicit deflator for gross fixed capital formation for registered manufacturing is derived from the data on gross fixed capital formation in registered manufacturing at current and constant prices given in the National Account Statistics (NAS). The deflator series is constructed for the period 1963-64 to 2003-04. The base is shifted to 1993-94 so as to be consistent with the price series used for inputs and output. (2) From ASI data, gross investment in fixed capital in manufacturing is computed for each year by subtracting the book value of fixed assets in the previous year from that in the current year and adding to that figure the reported depreciation in fixed assets in the current year.

Net fixed capital at constant price is taken as the measure of capital input. The net fixed capital series has been estimated by using the following equation.

\[ K_t = K_0 + \sum I_t \]

Where, \( K_t \) is the net fixed capital stock in year \( t \), \( K_0 \) is the Benchmark capital stock and \( I_t \) is the net investment series.

The net investment series has been calculated by using the following equation.

\[ I_t = GI_t - \delta K_{t+1} \]

Here, \( GI \) denotes gross investment and \( \delta \) is the rate of depreciation.

The gross investment at 1993-94 prices has been calculated by in following way.

\[ GI_t = \frac{B_t - B_{t+1} + D_t}{P_t} \]
In this equitation, $B_t$ is the book value of the fixed capital in year $t$ and $D_t$ is the depreciation of capital in year $t$. $P_t$ is the price index at 1993-94 base year.

Gross fixed investment for the years 1973-74 to 2003-04 could be computed from the ASI data. The series have been extrapolated backwards to 1963-64 with the help of the series on gross fixed capital formation in registered manufacturing (current prices) given in the NAS. To obtain real gross investment, the nominal figures have been deflated using the implicit deflator for fixed investment mentioned above. (3) The capital stock for 1973-74 (base year) is computed by aggregating real fixed investment for different years during 1962-63 to 1973-74, after making adjustments for annual depreciation. The rate of annual depreciation is taken as 5 per cent, which is the same as assumed by Goldar. (4) Starting from the fixed capital stock for 1973-74 (benchmark) and adding real net fixed investment for successive years, the net fixed capital stock series is constructed (Goldar 2004).

Other source of data is PROWESS, compiled by the Centre for Monitoring Indian Economy (CMIE). This data set covers the period from 1989 to 2007. The liberalization dummy takes 0 if it belongs to the period 1989 to 1993 as pre-reform and 1 if it belongs to 1994 to 2007 as post-reform period. The Foreign firm dummy takes 1 if it belongs to the foreign company and 0 otherwise. Other data sources are Department of Information Technology - Data Bank & Information Division, New Delhi; Department of Scientific & Industrial Research (DSIR), Ministry of Science & Technology; DATAQUEST-special issues; MAIT (Manufacturing Association of Information Technology) Directory; IMRB Indian Market Research Bureau; Electronics and Computer Software Export Promotion Council, Statistical Year Book of Indian IT and Electronics Industry; Electronics and Computer Software Export Promotion Council, Indian Exporters of Electronics Hardware, Directory; Electronics and Computer Software Export Promotion Council, ELSOFTEX News; IPAG (Information Planning and Analysis Group) NASSCOM (National Association of Software and Service Companies) Directories.

---

*Note: Goldar and Veeramani (2004) and Unel (2003) have taken the rate of depreciation as five percent per annum.*
1.6 Descriptions of Data and Variables

1.6.1 ASI unit level

In this study we use micro-level data. This data consists of important variables at firm level collected by the Annual Survey of Industry, Central Statistical Organisation (CSO), Government of India. This dataset is not available in a published form, but can be obtained electronically from the Annual Survey of Industry, CSO. The data used are for the years 1983-84, 1984-85, 1989-90, 1993-94, 1994-95, 1996-97, 1997-98, 1998-99, 1999-00, 2000-01, 2001-02, 2002-03, 2003-04 and 2004-05 for firms in the electronics industry, which covers units related to manufacture of office, accounting and computing machinery, manufacture of electronic valves and tubes and other electronic components, manufacture of television and radio transmitters and apparatus for line telephony and line telegraphy, manufacture of television and radio receivers, sound or video recording or reproducing apparatus, and associated goods, manufacture of medical and surgical equipment and orthopaedic appliances, manufacture of instruments and appliances for measuring, checking, testing, navigating and other purposes except industrial process control equipment, manufacture of industrial process control equipment [apparatus used for automatic continuous measurement and control of variables such as temperature, pressure, viscosity and the like of materials or products as they are being manufactured or otherwise processed], and manufacture of optical instruments and photographic equipment. This data has been concorded NIC-98 with NIC-87 by using concordance table. These products at five digit level have been compared with the products of Electronics industry, Data Bank of Department of Information Technology, New Delhi.

We use following variables for empirical analysis:

Variable calculation:

Total Output = Value of products & by-products + Income from services (industrial/non industrial including work done for others on materials supplied by them and sale value of waste left by the party) + Value of electricity generated and sold + sale value of goods sold in the same condition as purchased.

Total employees = Total workers + Supervisory & managerial staff + Other employees + Unpaid family members/proprietor/Coop. members
Total Workers = Male workers employed directly + Female workers employed directly + Child workers employed directly + Workers employed through contractors

Total input = Fuels consumed + materials consumed + work done by others on materials supplied by the industrial undertaking + repair & maintenance (building + plant & machinery + pollution control equipment + other fixed assets) + operating expenses + non-operating expenses (excluding insurance charges) + insurance charges + purchase value of goods sold in the same condition as purchased.

Fixed assets = Land + building + plant & machinery + transport equipment + computer equipment + computer equipment including software + pollution control equipment + others + capital work in progress

Energy = Fuel = Electricity purchased & consumed + petrol, diesel, oil, and lubricants consumed + coal consumed + other fuel consumed

Employees

The variables used in the model described above are calculated from unit level data of ASI as shown below.

Total employees = Total workers + Supervisory & managerial staff + Other employees + Unpaid family members/proprietor/Coop. members

Total Workers = Male workers employed directly + Female workers employed directly + Child workers employed directly + Workers employed through contractors.

Total Output = Value of products & byproducts + Income from services (industrial/non industrial including work done for others on materials supplied by them and sale value of waste left by the party) + Value of electricity generated and sold + sale value of goods sold in the same condition as purchased.

Total input = Fuels consumed + materials consumed + work done by others on materials supplied by the industrial undertaking + repair & maintenance (building + plant & machinery + pollution control equipment + other fixed assets) + operating expenses + non-operating expenses (excluding insurance charges) + insurance charges + purchase value of goods sold in the same condition as purchased.

GVA = Total output – Total input
Fixed assets = Land + building + plant & machinery + transport equipment + computer equipment + computer equipment including software + pollution control equipment + others + capital work in progress

Import = Total imports consumed

Wages & salaries = Wages of workers + supervisory & managerial staff + other employees.

Wages of workers = wages/salaries of Male workers employed directly + wages/salaries of Female workers employed directly + wages/salaries of Child workers employed directly + wages/salaries of Workers employed through contractors.

ASI classification of ownership is:

a) Wholly Central Government - 1
b) Wholly State and/or Local Govt. - 2
c) Central Government and State and/or Local Government jointly - 3
d) Joint Sector Public - 4
e) Joint Sector Private - 5
f) Wholly Private Ownership - 6

However, we have merged the first four into the category ‘Public’ and the last two into the category ‘private’. Their codes are:

Public = 0
Private = 1

Skill Intensity = ln(EMOLUMENTS/W AGES)

Capital intensity = ln (capital/output)

Import intensity = ln (import/output)

Contract labour = Workers employed through contracts (Average number of persons worked).

1.6.2 Variables Construction-Prowess Database

GVA = Gross Value Added = Salaries and wages + PBDIT (Profit before Depreciation Interest & Tax) + Interest and tax + Rent income
NVA = Gross value added – Depreciation

Output = Net total income

Price Cost Margin = [Value of Output – (Salary and Wages + Expenditures on Materials + Expenditure on Power)]/Value of Output

AGE Age of the firm i.e. Current Year minus Year of Establishment;

CI Choice of technology as proxied by Capital-Output Ratio;

EXP - Export intensity, Ratio of exports to sales turnover;

FOR EQU – Foreign equity participation, the share of dividends in foreign currency to total dividends paid;

SH – Structure - The structure of the market is represented by the firms share in the total industry sales.

SIZE - Sales turnover - Ratio of turnover to Fixed Assets.

ADV- Advertisement - Expenditure on Advertisement as a ratio of sales turnover.

RD – R&D intensity, research and development expenditure as a ratio of sales turnover;

VER_INT – Vertical integration – GVA as a ratio of Output;

IMPORTS

CMI – Capital goods import intensity, Ratio of capital goods imports to fixed investment;

MMI – Intermediate inputs import intensity, ratio of imports of materials, spares, components etc. to sales turnover;

MT - TECH IMP - Ratio of expenditure of technology imports to sales turnover; expenditure on royalty, technical fee, licensing fee and lumpsum payments as a ratio of sales turnover;

Central excise duty – Expenditure on excise duty as a ratio of sales turnover.

Liberalisation dummy – 0 for 1989-1993 and 1 for thereafter

Foreign dummy – 0 for Indian firm and 1 for Foreign firm
Price cost margin, Wage share and Central excise duty

Price Cost Margin = \[
\frac{\text{Value of Output} - \left(\text{Salary and Wages} + \text{Expenditures on Materials} + \text{Expenditure on Power}\right)}{\text{Value of Output}}
\]

Wage share - The income share of labor in gross value added.

Central excise duty – Expenditure on excise duty as a ratio of sales turnover.

Technology Acquisition

Dividend/Total Dividend = Ratio of Forex spending dividend to Total dividend

Imp Dividend = Import Dividend = Ratio of dividends paid in foreign exchange to sales

1.7 Chapterisation

This study is organised in seven chapters. Chapter 1 explains about the introduction of electronics industry under economic liberalisation. It consists of objectives, hypothesis, methodology, datasources etc.

Chapter 2 analyses performance (price-cost margin) and determinants of performance. To study this various conduct variables and structure variable are used. It has extended to study in detail structure (Herfindahl index) of electronics industry both at aggregate and disaggregate level viz. consumer, industry, computer, communication and component electronics. Further, attempt has been made to analyse the relations between price-cost margin, wage share and excise duty.

Chapter 3 analyses the partial and total factor productivity in electronics industry. Productivity has been studied at industry and firm level using ASI three digit and ASI unit level respectively. Methodology used for the study are Growth accounting – Translog method, Cobb - Douglas production function, Multilateral TFPG all India level and State level.

Chapter 4 analyses Growth Rates in Man-days per employee, Real Wage, Real Rent, emolument and output. This is followed by Employment behaviour at firm level (micro data) and industry level (ASI three digit) during pre-reform and post-reform period. At firm level, Employment has been regressed on Output, Tfp, Skill, Import and Owner. It has been studied for the first phase of reform period and the second
phase of reform period by using both GLS and OLS method. At Industry level, employment behaviour has been studied with growth of wages, mandays and output. Further, micro data (the unit-level ASI data) has been used to study, the relation among Emolument, Contract labour and Employees.

Chapter 5 investigates factors affecting export growth of electronics industry. In this, export behaviour comparison is made among aggregate, public and private electronics firms. It has extended to study whether economic reforms has affected in different sectors of electronics industry viz. aggregate, public and private. After studying export behaviour, following export analysis has been done, Export of electronics hardware, computer software and IT enabled service, Estimated contribution of states/UTs in export of electronics & computer software/services production, Item-wise major export of electronics hardware, Major destination for electronics hardware export, Country-wise electronics hardware export, Top exporter of computer hardware etc.

Chapter 6 Research and Development behaviour comparison is made among aggregate, public and private electronics firms. It has been extended to study whether economic reforms has affected in different sectors of electronics industry viz. aggregate, public and private. After studying Research and Development behaviour, following Technology analysis has been done viz. Technology acquisition in aggregate, public and private electronics companies, Technology acquisition in central and state government enterprises, Technology acquisition in foreign and Indian private sector. Linkages between Multinational Enterprises and Local Enterprises. It is followed by Expenditure on Research and Development by Industry Groups for Public Sector, Application for patents filed in India from 1980-81 to 2003-04 by foreign countries, Estimated Stock of S&T personnel, Estimated stock of Engineering degree holders in the working age group by selected disciplines, Research and Development expenditure, Advertising expenditure, New plant and machinery expenditure versus Sales turnover in public and private sector industry. Application for patents filled in India from 1980-81 to 2003-04 by different states etc.

Finally, in Chapter 7, the main findings of the study are summarized.
Reviews of Literature

Ajit K Ghose (2006) debates on Economy growth and its influence on employment, by emphasizing on traditional sector. His study is based on Lewi’s theory of Surplus labor and labour migration from labour surplus to resource rich economy. Some of the reasons for the existence of surplus labour in the economy are the unequal distribution of assets in the traditional sector and the trade union and government involvement in price fixing for labour/goods and taxation policies respectively. The objective is to ensure not only to increase the employment but also to improve the living conditions of labourers. The labour movement also takes place across the households, because resource rich (or labour-deficit) households can increase their income by hiring labour and also resource-poor (or labour-surplus) households can increase incomes by hiring their labour. He argues that if investment in traditional sector generates no profits or tax revenues for governments, then the unemployment level would increase in the next period.

Alakh N Sliarma (2006) study of Labour market reforms and its impact on employment shows that restrictive labour laws are the cause for inflexibility in the labour market. The flexibility of labour market would lead to the higher growth of employment. This study is based on secondary data that covers nine industries scattered in ten states. The findings are based on the research that was undertaken by the Institute for Human Development (IHD), New Delhi. In the study the factors that affect employment are the product market, the factor market, the nature of industry, the size of employment, the state wherein the units is located, the presence of a trade union and the choice of technology. They have discussed Employment growth, labour flexibility, wage flexibility, trade unions, state regulation etc. They explained that though the Indian labour laws are restrictive, numerous, complex and ambiguous, yet, it is quite flexible. The author concluded that the policy of free hiring and firing was nobody’s interest, the employers lose skilled labour and the workers lose jobs and income. He has suggested that there should be provision for re-training and active assistance for job search and retrench should be with sufficient notice and adequate as well as time compensation.

Atsushi Kato and Arup Mitra (2008) examined whether the import of technology affects the utilization of labour in manufacturing firms. They have used the PROWESS data compiled by the centre for monitoring Indian economy (CMIE) for the period from 1991-92 through 2001-02. They found that as the ratio of foreign to domestic capital stock increases, the ratio of labour to value added tends to be lower. The ratio of foreign to domestic capital stock have experienced upward trend since the early 1990’s. The rapid growth of the Indian manufacturing sector since 1990’s, resulted weak absorption of labour because of higher import of foreign capital.

Bhaduri and Ray (2004) studied export behaviour of Indian pharmaceutical and electronics/electrical industry and analysed importance of research and development
and foreign ownership. They found that Indian pharmaceutical industry's export is
determined by foreign ownership and research and development output relative to
research and development expenditure is more important than absolute research and
development output. In Indian electronics/electrical industry export is determined by
know-how output.

Chandana Chakraborty and C. Jayachandran (2001) analysed the preliminary survey
conducted among a wide group of software-related companies. More than 200
questionnaires were sent to such companies in the major cities of India including
Bangalore, Chennai, Hyderabad, Pune, Mumbai and Kolkata. They have provided an
analytical framework for examining the organizing and size of the Indian software
industry. The analysis shows that programming services is the largest source of
revenue for the aggregate industry, and it mainly relies on software services exports.
The Indian software industry lacks diversification in types of production and exports.
According to them, if the industry is to expand domestically and internationally,
major reforms have to take place in infrastructure planning and government policies.

Chandrashekhar C.P. (2005) studied the role of private and government sectors in the
development of IT industry output and the ratio of IT sector output to GDP. He
compared the salaries of Indian software professionals with that of the United
States. He analysed the state-wise teledensity and compared Internet connectivity with
countries of the Asia-Pacific region. He also studied IT growth and the role of the
state. He concluded that India's IT industry production, exports and the ratio of IT
sector output to GDP have been increasing continuously. Taking all costs into
consideration, the cost of software development in India is half of that in the United
States. Relative to outsourcing competitors like Ireland and Wales, India is estimated
at a half to a third. He suggested a more proactive role for the state in influencing the
pattern of growth of this sector, instead of leaving matters to market.

Currie and Harrison's (1997) study was based on how trade reform affected
employment in Morocco during the 1980s. The study is based on firm level and the
firms were classified on the basis of a) ownership, i.e., public and private, b) export,
i.e., large export and small export firms. The total log of employment was regressed
on tariff and quotas. It was found that there was no change of employment at
industry level. They also found that those firms which had some degree of public
ownership experienced an inverse relation between tariff and employment. Export-
oriented firms experienced high degree of employment reduction due to decrease in
tariff protection. Other firms also recorded a similar trend i.e., decrease in
employment due to reduction in tariff protection. In another estimation, the result of
labour demand model showed that labour reform had not affected employment level
much. This was because entrepreneurs reduced profit margin and increased
productivity leaving employment unaffected.

Fallon and Lucas' (1993) study of Employment function of India and Zimbabwe has
shown that there is a decline in demand for employees in manufacturing sector in
both the countries. For the study of Indian manufacturing industries they used the Annual Survey of Industry data published by the Central Statistical Organisation, Government of India, and the time period for the study was 1959 to 1981. The Census of Production data for Zimbabwe was used for the country’s manufacturing industries, and the time period was from 1960 to 1984. The CES cost minimization model was used for the study of dynamic labour demand. The Employees has been regressed on wage, man hours, output, and job security regulation dummy.

Goldar B, Renganathan V S and Rashmi Banga (2003) analysed the effect of ownership on engineering firms in India in the 1990s. A comparison of technical efficiency was made among three groups of firms in Indian engineering: (i) firms with foreign ownership, (ii) domestically-owned private sector firms; and (iii) public sector firms. They found that the foreign firms in the Indian engineering industry have higher technical efficiencies than domestically-owned firms. No significant difference in technical efficiency is found between private sector and public sector firms among the domestically owned firms. However, in the beginning there are indications of a process of efficiency convergence—domestically owned firms tending to catch up with foreign owned firms in terms of technical efficiency. There is a positive relationship between international trade orientation of a firm and its level of technical efficiency. It shows that in the first half of the 1990s there was significant positive productivity. There were spillover effects from foreign-owned firms to domestically-owned firms. The used the Prowess Database of the Centre for Monitoring Indian Economy (CMIE). The sample consists of 63 firms in the engineering industries and the data for the firms were for 10 years, from 1990-91 to 1999-2000. The key variables are output, labour, capital, sales (net), exports, imports, Research & Development, value of import of raw materials, total purchase of raw materials, profit before tax, excise duty, gross output and foreign equity.

Goldar B.N. and Agarwal R.N. (1999) studied the behaviour and performance of medium and large engineering firms (public limited companies) in the pre-reform (1988-91) and post-reform (1992-95) periods based on a cross-section of firm-level data supplied by the Reserve Bank of India. The analysis focuses on four variables, which are important firm-level performance indicators and also represent, in some ways, the behaviour of the firms. These are technology import intensity, growth of firms in terms of sales/output, level of technical efficiency, and export intensity. They concluded that the inter-firm pattern of growth has shifted in favour of export-oriented firms. The correlation between technology imports and export intensity and also growth rate and technical efficiency have become stronger in the post-reform period as compared with the pre-reform period. Regression results for the import of technology show that profitability, age and vertical integration have become import determinants while export intensity has lost significance in the post-reform period. In explaining the growth behaviour, the export intensity variable has assumed importance with a positive coefficient. In the export intensity equation, technical
efficiency and advertisement expenditure intensity have become significant with a positive coefficient in the post-reform period. As far as policy implications are concerned the study has clearly pointed out that a strong relationship has emerged between growth and export performance among the engineering firms after the beginning of economic reforms in 1991. In order to sustain the growth of engineering firms, policy measures are required to encourage exports. This may include an appropriate exchange rate policy and removal of administration hurdles and other bottlenecks.

Goldar B.N. and Anita Kumari (2002) compared the growth rate Total Factor Productivity (TFP) in Indian industries in the 1990s, i.e., the post-reform period, with that in the 1980s. They also made an econometric analysis of inter-temporal and inter-industry variations in productivity growth rates, aimed at assessing the effect of import liberalization on productivity growth in Indian industries in the 1990s under the economic reforms programme. There was significant growth in total factor productivity in the 1980s and there has been a notable decrease in the growth rate of TFP in the post-reform period. The reduction in effective protection to industries appears to have had a favourable effect on productivity growth in Indian industries, and there was a step up in investment activity in Indian industries following the reforms.

Goldar Bishwanath (1995) focuses on technology acquisition and productivity growth. He considered that productivity performance of industries depends on a number of factors; a key determinant of productivity growth in the medium to long term is the pace at which new advanced technology is acquired and brought into use. To what extent technology transfers of various kinds get translated into productivity gains also depends on the technological capabilities of the recipient firms and the local conditions including the economic policy framework. He concludes that the technology imports and capital goods imports together, which indicates the rate of inflow of foreign advanced technology in Indian industries, was significantly higher in the 1980s as compared to the 1970s. The foreign equity ratio and the ratio of dividends paid in foreign exchange to sales have declined in the 1980s. This decline is due to the foreign exchange regulation act which forced companies to dilute the foreign equity holdings less than 40 per cent. The ratio of imported intermediate inputs to sales rose significantly in the 1980s compared to the 1970s. He found that, interestingly, the chemical and chemical products group ranks low in terms of technology import intensity but had the highest growth rate in productivity. On the other hand, non-electrical machinery group which was on top in terms of technology import intensity had the lowest rate or productivity growth. It seems that the Indian industrial firms were not able to take adequate advantage of the imported technology.

Goldar Bishwanath (2009) study of Trade liberalization and Demand elasticity of Indian manufacturing industry have shown that there is positive relation between the two, in other words the trade liberalization has increased the labour demand
elasticity. The studies data source is based on Annual Survey of Industry, Central Statistical Organisation, Govt. of India. The data covers for 1980-81 to 1997-98 and for the study of inter-temporal changes in the elasticity during 1973-74 to 2003-04. This result corroborates with the Rana, Hasan et al. (2007), study indicating the trade reform has resulted labour demand elasticity of Indian manufacturing industry. Industry has experienced downward trend during pre-reform period whereas mid 1990’s onwards it experienced upward trend. The author justified the result by explaining the labour reforms and the declining bargaining power of trade unions were the reasons for positive relation between trade liberalization and demand elasticity.

Harilal K.N and Joseph K.J. (2001) studied the structure and growth of India's IT exports and showed that India is focusing on the lower end of the value chain, i.e., onsite services popularly known as 'body shopping' where factors move to the site of the receiver. They suggested a policy change to encourage a move to the high end of the value chain to increase the offshore component. They also looked into the implication of the IT boom on the availability of skilled manpower in other competing sectors and the possible threats to the sustained growth of software exports. They have emphasized the need for proper incentive structure and supply of technically-skilled personal. They also believe that the diffusion of IT into other areas will help in the sustained growth of the sector.

Jang, Weng and Wang (2005) studied Taiwan’s manufacturing and electronics industry. They have compared the extent of plant-level diversification in the electronics industry and manufacturing as a whole. They reviewed the production activities of more than 20,000 Taiwanese electronics plants during the period 1992–1999. In an inter-industry comparison, they find that at the four-digit and seven-digit industry levels, Taiwanese electronics production plants exhibit a significantly higher degree of product diversification than plants in the manufacturing sector as a whole. Empirical results suggest that when all other control variables concerning plant-specific and industry-specific characteristics are neutralized, the productivity growth rates within the electronics plants are greater, the higher the degree of diversification.

Joseph K J (1989) has attempted to analyse the electronics growth performance in terms of structural changes and their impact on different facets of industrial growth: income, employment, and foreign exchange. The 1980s' statistical evidence shows that the 'sunrise' industries are electronics, petrochemicals and automobiles. These new industries are the major ingredients of the growth recipe, and among them electronics is the fastest growing one. He found that the industry had grown at an annual compound growth rate of 18 per cent during 1971-80, and 33 per cent during the post-1980 period. During the 1970s the three sub-sectors, namely, consumer, professional and components have shown balanced growth with the respective growth rates being 17 per cent, 20 per cent and 17 per cent. During the post-1980 period the role of the private sector increased considerably and that of the public
sector and the small-scale sector reduced. With an increase in output growth, the employment generation capacity of the industry declined.

Joseph K.J. (2004) traced the structure and growth performance of the electronics industry in an evolutionary perspective. He classified electronics industry into three groups, namely, consumer goods, capital goods and intermediates goods, from 1971 to 1998. His findings showed that the growth rate of all the sub-sectors has declined over the period. Since the 1980s there is a gradual but steady move towards an open and market oriented regime through a series of policy changes. In the product structure he traced out a higher share of electronics capital goods, and there has been a steady and definite shift in production away from the small to the large-scale sector. Analysing Labour/Output (L/O) and Labour/Capital (L/K) ratios, he showed that there is a scale down in terms of its direct employment generation potential. As far as regional development is concerned, production is heavily concentrated in Maharashtra and Karnataka in 1971. The combined share of Maharashtra and Karnataka in the total production declined from 75 per cent to 38 per cent in 1993.

Krishna et al. (2001) estimated Turkey’s employment function for the period 1983-86, when liberalization took place. This study covers the manufacturing industries at three digit level in Turkey. Here the employment has been regressed over the wage rate, rental rate, material price, fuel price, and the liberalization dummy. They haven’t found any major impact of trade openness on labour demand.

Kumar and Siddhartahan(1994) focused on export behaviour for 640 firms across thirteen industries, the period was from 1987-88 to 1989-90. The industry has been classified as low, medium and high-tech categories. The independent variables are technology imports, in-house innovation, firm size, advertisement intensity, skill intensity, capital intensity, foreign equity etc. The research and development positively associated with the export of both low and medium technology firms. As firm size increased export has decreased initially, later it has increased. Technology imports and capital intensity were positively associated with electrical machinery, whereas Non-electrical machinery has found positive sign with import dependence, technology imports, profitability, skill intensity, foreign equity dummy.

Lal K (1995) tried to identify and analyse the principle discriminates that separate the firms using information technology (IT) from the rest. The study also identifies the main characteristics of IT and its impact on behaviour of the firms. To study the performance of the firm that is influenced by conduct and structure, he used structure-conduct-performance (S-C-P) paradigm. Seventeen discriminating characteristics were included in the analysis. These characteristics cover the following broad aspects: Technological and skill intensity, performance of firms, international orientation, firms’ history and sources of competitiveness. The evidence obtained from this study confirms the vital importance of top managers’ qualifications and technical orientation in the development and implementation of IT strategy. The entire productive system can be made more productive through the use
of computers through planning and co-ordination of activities. The use of IT will favourably influence other conduct variables. The conduct of the firms, in turn, influences their performance as reflected in exports, profit margins and market share. Firms with better performance (profit) record are likely to invest more on IT and research and development activities, spend more on quality control and employ better skilled workforce.

Lall (1986) examined the relation between technology variables and export performance for hundred engineering firms and forty-five chemical firms. The technology variables are the value of royalty and licensing fees paid abroad, Research and Development and equity held by foreign firms. The result shows that the foreign share in chemical firms is positively associated with the export. The research and development is significant in both the industries but positively with chemical firms and negatively with engineering firms. The licensing agreements of foreign firms had a positive effect for engineering firms. The firm size is positive for the engineering firms and insignificant for the chemical firms. The technology variables show that research and development is playing major role in chemical industry to that of engineering industry.

Manoj Pant and Manoranjan Pattanayak (2005) examined the effect of insider ownership on corporate value in the Indian corporate sector. They used prowess (CMIE) database consisting of 1833 firms that are listed in BSE and NSE with 7330 observations of both large and small firms. For each firm, they used four years of observation, i.e., 2000-02 to 2003-04. The hypotheses of their study were: a) Firm performance is a non-monotonic function of share ownership by insiders and b) Firms with a foreign promoter/collaborator will have a higher market value than completely domestically owned firms. To measure ownership effect, Tobin’s Q value has been used, i.e., the ratio of the market value of equity (measure of profitability) and Q-ratio has been regressed on measures of insider ownership share, as well as other variables which should affect Tobin’s Q. The other variables are control variables, year dummy, operating expense ratio, asset turnover, Research & Development, current expenditure in fixed capital, and foreign presence. They have compared the market value of BSE 500 firms with non-BSE 500 firms. They concluded that the convergence of interest or monitoring hypothesis predicts a positive relationship, while the ‘entrenchment’ hypothesis predicts a negative one. The relationship between insider shareholding and firm value is not linear in native and shows significant non-monotonic relationship between the two. Tobin’s Q first increases, then declines and finally rises as ownership by insiders rises. They also found that foreign promoter/collaborator share holding has a significant positive impact on firm value.

Misra and Ajay Shah (1997) studied India’s National Information Infrastructure. Electronics industrial development is mainly dependent on National information infrastructure. They suggested that for smooth functioning contractual relationships
should be facilitated by high quality communications and information exchange. Since the costs faced in building a variety of other infrastructure, the information infrastructure, is a remarkably inexpensive way to enhance the productivity of India’s economy. Their suggestions are as follows: 1) The most useful vision for IndiaNET is a purely domestic computer network, which would link up individuals, firms, government, researchers and non-profit organizations in the country. 2) For a maximal impact upon productivity growth in India ‘Closed User Group’ policy of the DOT has to be eliminated. 3) IndiaNET should aim to be a backbone, supplying high speed links.

Narayan D and Joseph K J (1993) addressed the issue of economic liberalization and the industrial response. The industries studied are motor vehicles (assemblers + component manufacturers) and electronics, both having a structure which facilitates taking up components that greatly differ from one another. They discussed the growth performance and foreign collaboration in motor vehicles and electronics industries, and also suggested certain basic issues lost sight of in the reform process. The annual average compound growth rate of electronics industry has been recorded 8.4 per cent during 1971-81, 26 per cent during 1981-88 and 6.7 per cent during 1988-91. The share of financial collaborations increased from 14 per cent in 1978 to 37 per cent in 1991. They asserted that India has a large pool of scientists and engineers and certain advanced learning systems within its public sector enterprises and research laboratories. According to them, to boost the economy it is essential to convert these into technological capability along with encouraging foreign investment.

Narayanan (2006) analysed export behaviour of Indian automobile firms. He classified the study into three periods viz., licensing, deregulation and liberalization. The independent variables used are research and development, import of capital goods, import of technology foreign equity participation and interactive variables. He found that the interactive terms, research and development with import of capital goods is positive and significant for export competitiveness in the deregulation period. Foreign equity participation is positive and significant in both licensing and liberalized periods. During deregulation period embodied technology as well as disembodied technology imports experienced negative effects on exports.

Narayanan K (2004) has attempted to analyse the determinants of growth of Indian automobile firms (old & new) during three different policy regimes, namely, licensing (1980-81 to 1984-85), deregulation (1985-86 to 1990-91) and liberalization (1991-92 to 1995-96). The study emphasizes technological acquisition and growth of firms. It examines issues such as the relationship between growth, size, technology and profitability of firms. To carry out this analysis, the paper largely followed the evolutionary theoretical approach of Nelson and Winter (1982) and Dosi et al (1992). In analysing inter-firm and inter-temporal differences in growth of sales, the study examines the role of technology acquisition, along with size, profit, age, capital
intensity and vertical integration and highlights the relative importance of all these variables in determining growth across three different policy regimes. One major limitation of this exercise is the calculation of growth at current prices. He concluded that, in a liberal economic policy regime, firms, which relied mostly on intra-firm transfer of technology through foreign equity participation, grew faster than others did. The positive relationship between firm size and growth also confirms the existence of certain scale advantages in achieving high rates of growth. The results also confirm that new firms grow at a faster rate than their older counterparts.

Nickell and Wadhwani (1991) estimated employment function for the UK over the period 1972-82. This study is based on unit level, and the log of employment as a dependent variable regressed over fifteen independent variable, which covers social welfare benefit of labour. Many of the variables are used in log terms. The independent variables are capital stock, industry output, market capital, debt-equity ratio, own real wage, industry real wage, industry unemployment rate, aggregate real wage, aggregate unemployment, real social security benefit, industry union density, firm effect and industry index. The results brought out that the variables like own real wage, capital stock, debt-equity ratio etc., have been playing a dominant role to determine the employment growth and as the classical economists view the wage has negative effect on employment.

Panchanan Das (2007) tested Kaldor’s hypotheses of whether manufacturing output has impact on overall economic and employment growth. The study covers the period over 1970-71 to 2002-03 and focuses on two states namely, West Bengal and Gujarat. The data used are National Account Statistic (NAS) and Annual Survey of Industries, Central Statistical Organisation, EPW Research Foundation, 2003. The NAS data has been used for estimating growth rates of domestic products at the national level from 1970-71 to 2000-01. The NAS different series are constructed a consistent chain linked time series of SDP by extending the 1993-94 series backwards (Splicing method). To study trend behaviour of output and employment semi-logarithmic trend model and for the state level analysis, generalized least square (GLS) method of fixed effect pooled regression have been used. His study of Kaldor’s hypotheses are i) The faster the rate of growth of manufacturing output, the faster will be the rate of growth of GDP, ii) The growth of labour productivity in the manufacturing sector is positively related to output growth. The results depict that simple regression results show strong relationship between employment and output growth, there has been no causality between them at the national level and also in Gujarat.

Pandit B.L. and Sidharthan N.S. (2008) estimated an employment model relating it with MNE’s, product differentiation, skill etc. The study period is from 1992 to 2001, the data sources are Annual survey of industries and the capitaline. The employment, output, skill, and wage rates have been taken from ASI, whereas the MNE’s Product differentiation and technology import are taken from the Capitaline.
In the model, the employment growth has been regressed on labour productivity, Growth of value added, skill intensity, MNE’s, product differentiation, wage rate and technology imports. They found that the all the variables except technology imports were significant. Employment has been found positive relation with output, product differentiation, MNE’s presence and skill whereas wage rate and labour productivity have experienced negative sign.

Pattanayak (2008) examined the interaction effect of product market competition and corporate governance variables on firm performance (productivity). The study is based on a panel data consisting of 1660 firms over the years 2000-01 to 2003-04. The study found that performance of firm is positively associated with Institutional investors, Corporate ownership, Foreign ownership, Firm size, R&D, Advertisement, Capital Import, Vertical integration whereas it is negatively related with Development financial institutions, Concentration ratio and Excise duty.

Pianta (2000) examined the employment behaviour of industries in European countries for the period 1989-93. The employment has been regressed over value added, innovation intensity, product innovations, share of new products in sales, export, and labour cost. This estimation is based on pooled data for various manufacturing industries and European countries viz., Germany, Italy, Denmark, Netherlands and Norway. The results found that the value added and product innovations had a positive impact on employment.

Pradhan (2007) has examined how emerged multinationals have affected the exports from the home country. This study covers over 11 years from 1990-91 to 2000-01 and the data sources are Centre for Monitoring Indian Economy (CMIE), Published reports of Indian Investment Centre (ICC), Research and Information System (RIS). He found that the FDI by Indian multinationals have played important role in improving exports. Foreign affiliates of Indian enterprises may also help to enhance export by sourcing raw materials, capital goods and intermediate inputs from India. The other variables R&D activities, foreign affiliations, and liberalization policy have experienced positively with export.

Pradhan et. al. (2006) have analysed the determinants of market-seeking foreign direct investment (FDI) to undertake export activities. They have been estimated GLS, Fixed Effect method for a panel dataset of 14 Indian industries for 14 years over 1992-2005. The data sources are Centre for Monitoring Indian Economy (PROWESS) and India Trades. They found that the Domestic Market capturing the size of the domestic market emerges with a negative sign. In other words, the large size of the domestic market is more attractive for foreign firms and tends to slow down the diversification process of their focus towards export market. Domestic competition turned out to be negative. The export-intensity of domestic firms has a strong positive relation with foreign firms export intensity. R&D intensity and Advertisement intensity possess negative sign whereas Age has positively associated with foreign firms.
Pramod Mantravadi and A Vidyaadhar Reddy (2007) have attempted to study the impact of mergers on the operating performance of acquiring corporates by examining some pre- and post-financial ratios with a sample of firms chosen from all mergers involving public limited and traded companies in India between 1991 and 2003. They chose this period because India experienced different trends in the initial period of the reform; there was intensive investment activity, a wave of consolidation within Indian industry. The second significant trend, since 1995, saw increased activity in consolidation of subsidiaries by multinational companies operating in India. The third trend, since 2002, was that of Indian companies venturing abroad and making acquisitions in developed as well as in developing countries. They emphasized the two main objectives behind mergers and acquisitions were: (i) improving revenue and profitability and (ii) faster growth in scale and quicker time to market. To study this, they have adopted the following financial ratios: Operating profit margin, gross profit margin, net profit margin, return on net worth, return on capital employed and debt equity ratio. They found that stock for stock mergers in India in the post-reform period led to a decline in the net profit margin, while other profitability ratios didn’t change after the merger. Merging firms in the sample also saw a decline in the returns on the net worth and capital employed. It also suggested that mergers in the Indian industry had not improved the operating efficiency of acquiring firms.

Pulapre B, Pushpangadan K and Suresh Babu M (2003) analysed productivity growth in the manufacturing industry for the period since the trade liberalization. The panel data of 2300 firms spread over five industry groups and yielding over 11,009 observations was assembled from the database on electronics medium (PROWESS) of the CMIE. The industry groups chosen were machinery, transport equipment and parts, textiles, textile products and chemicals. The period 1988-89 to 1997-98 was chosen for the study. The objective of the study was to investigate a shift in productivity growth from the year 1991-92. They understood that the route from increased competition and the liberalisation of trade to higher productivity growth is less than clearly defined. The discovery of the absence of any significant improvement in productivity growth since 1991-92 tends itself to two interpretations: either the period studied is too soon after the launching of reforms for there to have emerged the, allegedly inevitable, increase in the rate of productivity growth; or the policy instruments employed are inadequate for the task.

Qiwen Lu’s (2000) study of China’s leap into the information age has attempted to answer the question, “Why are the indigenous Chinese firms able to catch up with MNC computer giants?” He observed that learning can start at any stage of the technology ladder and traverse through in any manner. His analysis shows that the advantage of this strategy is securing market acceptance of the new products and accumulating much needed capital for further investment in Research and Development and manufacturing. Foreign collaboration not only leads to
technological transfers but also provides foreign managerial and marketing know-how. The government had an indirect influence through sophisticated tax concession schemes and loan scheme of state banks with preferential interest rate that have been devised to promote innovations in products and processes for firms in targeted industries. These institutional devices and the corresponding regulatory regimes have created incentives and provided resources to induce firms to pursue ongoing improvements in products and processes.

Rajarshi Majumder (2006) using Annual survey of industries for organized and NSSO for unorganized sector for the period of 1989-90, 1994-95 and 2000-01 has studied employment and wage relation in the liberalization regime. The author’s objective is to see how the wage rise has resulted for the jobless growth and to study the factors that are affecting the growth of employment and wages. The study postulated that employment would be affected by gross output, technology, wage levels and regional economic conditions etc,. The result shows that the employment is positively associated with the output and the relation with non-primary workforce is also positive, depicting that the manufacturing sector absorbs surplus labour shifting out of the primary sector. The output elasticity of employment is more than one for small manufacturing enterprises and less than unity for the larger firms and the organized sector. The Workers bargaining strength is the least, resulting decline in wages even when the productivity increased. The presence of the Reserve army is the reason for it and encourages the contract labour. The author suggested for the industry specific policy rather than blanket policy for the employment growth.

Reenen (1997) estimated the employment function of the British manufacturing industry for the period 1979-82. This study emphasized invention and innovation and its impact on employment level in the British industries. The dependent variable is employment and the independent variables are capital, wages, innovation and one year and two year lag of employment. All the variables were in log terms. He found that the employment and the technology innovations were positively related.

Revenga (1997) examined the impact of trade reform on employment in the Mexican economy over the 1984-90 period. His study of employment behaviour is based on both unit level and industry level, and the database is Annual Industrial Survey, Mexico. The firm-level study of employment function’s dependent variable is employment and is regressed over real wage, the cost of capital, the real sales and the price of raw materials. He found no change in the firm-level employment due to changes in tariffs; however, inverse relation between output quota and employment was found. He also found an inverse relation between the reduction in licensing coverage of imported inputs and employment. In industry level study, the average number of workers is used as a dependent variable and it has been regressed on cost of capital, the price of raw materials, the protection rate variables (tariff rate, license etc..), and the real average wage. The study found a positive relation between
restriction on imported inputs with employment and no significant relation between employment and quotas.

Rui Baptista and Peter Swann G.M.'s (1999) study compares the structural change and geographical clusters of computer industry in the United States and United Kingdom. In both the countries new firms are attracted by their industrial strength in particular sub-sector in particular regions. They concluded that the technological discontinuities, resulting from radical innovation can lead to the loss of competitiveness by users of technologies that draw upon the old science base, favouring attacks from prospective entrants. The clustering dynamics of the United Kingdom is as strong as the United States'. The better performance of the United States' computer industry as a whole is possibly due to structural differences.

Salim Lakha (1990) examined the growth of the computer software industry in India. He also discussed the issues related to the computer industry, namely, Government policy, Human resources, Research and Development, Markets, and Foreign collaboration. India is performing better in undertaking software assignments on a turnkey basis and even in Computer Aided Design (CAD) and Computer Aided Manufacturing (CAM) that requires high labour skills inputs. The global ratio of hardware to software budget outlay is 30:70 whereas in India it is 60:40 due to higher hardware cost. He has concluded that the availability of quality labour, and government policy are the most important factors of the expansion for software sector.

Sangamitra Das (2004) in her work "The Computer Hardware Industry" focused on the growth of personal computer industry in India. She found the entry of several players combining varying degrees of imported technology and components to service the growing demand. Her findings are that the survival of electronics industry is positively related to product quality but not to quantity per unit price or value, and users seem more quality-conscious than value conscious. The firms using foreign technology, obtained through joint venture or licence, have higher product quality than those using domestic technology. Moreover, the public sector has not been very effective in providing either good quality or high value products.

Sarosh K and Stephen F (2001) examined the impact of globalization on employment relations in the diverse electronics industries in India, China, Malaysia and the Philippines. They found that globalization leads to international commonalities. First, the electronics firms are not unionises, possibly due to two factors: management's ER strategy, and government policy. Second is performance-related pay structure. Third is the stress on training. Fourth is considerable variation in employment relations practices within countries in the electronics industry. As far as the high road and the low road models are concerned, India is clearly moving towards a high road model, Malaysia and Philippines suggest the existence of mixed models, whereas China demonstrates the low road model. Tight labour markets and functional flexibility strategies in India and Malaysia have clearly raised wages and skills.
Philippines shows functional flexibility co-existing with outsourcing which contributes benefit to a small group of skilled workers, while a larger group of unskilled workers are pushed into the informal sector or lose employment through numerical flexibility strategies. The low road approach in China is predicated on the intensive labour of migrant workers undertaking repetitive work for low wages.

Siddharthan and Nollen (2004) examined the Indian information technology sector, it has been classified into three groups on the basis of ownership viz., MNE affiliates, licenses and domestic firms. The study period is from 1994-98 and the data source is taken from Capitaline. They found that MNE’s affiliates are using foreign technology and technological skills to compete in foreign markets. For the group of licenses, import of technology and export are negatively related. For other group of firms, capital intensity, firm size and foreign market exposure are positively associated with exports.

Sidharthan N S and Lal K ( ) studied the impact of liberalization on productivity of Indian as well as multinational enterprises for the period 1993-2000. They have argued for unbalanced (full) panel to analyse productivity spillovers, essential to take into account the entry of new enterprises and the exit of the older ones. They have also advocated another measure, namely, value added per unit cost of labour, to avoid the problem posed by skill diversities and the consequent wage differentials of the workers. To avoid the problem of price deflators, they estimated separate regressions for each year of the period 1993-2000. Accordingly they do not combine time series and cross section data. Instead, in each equation they consider only the cross section of firms for that year. They found the presence of significant spillover effect of FDI. During the initial years of liberalization, the spillover effect was modest but later this increased sharply and stabilized towards the end. Domestic firms that possessed higher labour productivities and had lower productivity gap with MNE were able to enjoy higher spillovers, while those with larger productivity gaps couldn’t benefit much. Consequently firms with better endowments in terms of productivity and technology benefited from liberalization and FDI presence.

Simona Iammarino et. al. (2008) has studied the electronics industry, its technological capabilities and Global-local interactions in two Mexican regions. Their aim is to examine the main determinants of advanced technological capabilities of firms and regions in an FDI-dominated manufacturing sector. For this study they have analysed product-centred capabilities for the firms, and for components, attributes and relationships in the regions. They found that the most important mechanism of technology transfer for developing capabilities in locally-owned firms was the knowledge acquired by local personnel when they worked for foreign subsidiaries. The other important factors were four endogenous viz. strong indigenous human capital, strong local innovation-oriented organizations, links and interactions among components, and an active public sector, three exogenous factors viz. origin of capital, sector and historical paths.
Tae-Young Park et. al. (2007) studied Korea’s Thin Film Transistor-Liquid Crystal Display (TFT-LCD) and Dynamic Random Access Memory (DRAM) industry. They have investigated their spillover into the areas of technology, human resources and organization, and network. They found that DRAM’s technological capability transferred into TFT-LCD in the form of investment funds, the accumulation of semiconductor technology required for TFT-LCD R&D, timely investment in technology, DRAM’s production and quality management systems, the movements of key personnel to the TFT-LCD business, and the capability of organizing production labour.

Taylor and Driffield (2001) studied UK’s manufacturing industries with the objective of finding out whether technological change, globalization and MNE’s have influenced employment. They found that technological change, multinational participation, import etc., had influenced employment level in the manufacturing industries in the UK. The study of skilled and unskilled labour shows that absolute job losses have occurred because globalization favours skilled labour. In other words, the job gained by a few skilled labours resulted in more loss of jobs by unskilled labour. They used the 3-digit data of UK’s manufacturing industry, over a 10-year period from 1983 to 1992. The Employment function has been estimated at two levels: Fixed effect, Random effect and GLS method. The explanatory variables are sales, imports, exports, R&D stock, wage, capital stock, foreign-owned multinational’s employment share in the UK’s manufacturing industry and coefficient variation of the regional distribution of value added in the industry.

Vibha Pingle’s (2000) study focuses on the origin of the computer policy and the structure of state agencies created for electronics industry. It also examined inter and intra organizational factors influencing the shifts in Hardware and Software computer policy. She has concluded that the factors like autonomy of technocrats, informal ties between technocrats, software entrepreneurs and the bureaucrats have influenced the structure of computer industry. The NASSCOM (Software manufacturers’ association) and MAIT (Computer manufacturers’ organization) interaction with the department of electronics, department of commerce and department of finance have resulted in the growth of electronics industry. She has emphasized the coordination of all these organization would enhance India’s information technology industry.

Vinish Kathuria (2002) examined the effect of liberalization and entry of foreign firms on productivity of local firms. The hypotheses are: (a) The larger is the presence of foreign firms and technology import in the sector, the faster is the efficiency growth of domestic firms, and growth is even faster for the firms that invest in Research and Development activities; and (b) the larger is the entry of foreign firms or level of imports in the sector, the faster is the efficiency growth of domestic firms. He concluded that after liberalization, the productive efficiency of Indian industry had improved, but the increase in efficiency was greater for the
foreign-owned firms. It was only ‘scientific’ non-FDI firms that had benefited from the trade liberalization (import penetration), and productivity largely depended on the level of investment a firm made on research and development activities.

Banga and Goldar (2007) study the contribution of services to output growth and productivity in Indian manufacturing pre- and post-reforms using the Annual Survey of Industries data. The main objectives of the study were (1) What has been the contribution of services to the growth in Indian manufacturing industries? Has the relative contribution of services to industrial growth increased in the post-reforms period? (2) Has the growing use of services as input contributed to increases in productivity in Indian manufacturing industries? (3) To what extent is the fast growth in the use of services in Indian industries a consequence of the economic reforms, particularly trade reforms undertaken in the 1990s? They found that the importance of services as an input to production in the manufacturing sector increased considerable after liberalisation at a greater pace comparable to before that. Contribution of services to growth increased from 1 percent in 1980s to 25 percent in 1990s. Trade liberalisation made this process more favorable towards greater use of services in the manufacturing sector.

Veeramani and Goldar (2005) analyse the influence of the investment climate on total factor productivity in the registered manufacturing sector across the major Indian states using the Annual Survey of Industries data. They found that friendly investment climate has a significant and positive effect on Total Factor Productivity. The states where there is friend investment climate would grow faster and be able to eradicate poverty quicker than other states. They argued that in order to eliminate region disparity lagging states initiate reforms to make their investment climate market friendly. Along with this they also pressed the importance of transparent government regulations, policies and practices in industrial development by ensuring the security of property rights, by investing in the development of social and economic infrastructure, and by ensuring a smooth functioning of the finance and labour markets.

Mitra (1999) has studied the total factor productivity growth and technical efficiency in Indian industries based on the panel data for 15 major states using the Annual Survey of Industries data. The study followed the methodology of Cornwell, Schmidt and Sickles to estimate the time varying technical efficiency and total factor productivity growth for 17 two digit industry groups. During 1985-86 through 1992-93 in a large number of industries and across most of the states TFPG seems to have improved. At the national level, there was hardly any growth of TFP in the organised industrial sector, between 1976-77 and 1984-85 but in the subsequent years it grew at a rate of 5.57 per cent per annum. Several states in which the organised industrial sector experienced a positive total factor productivity growth during 1976-77 to 1992-93, also witnessed more or less such a shift from a phase of ‘no growth’ or ‘sluggish growth’ or ‘negative growth’ of TFPG during the first sub-period to a
phase of positive growth during the second subperiod. Acquisition of technological capabilities and infrastructural development has possibly contributed to this change.

Agarwal (2001) has studied the technical efficiency and productivity growth in the central public sector enterprises, industry group-wise and firm-wise in India during 1990s. His study is based on the data for 58 large Central Public Sector Enterprises for the period 1990-91 to 1998-99. Partial productivities and the Solow index of total factor productivity growth have been used for estimating productivity growth. Cornwell, Schmidt and Sickles's method has been used for estimating the technological change and growth of technical efficiency at the firm level. The results show that the public sector enterprises have not experienced a significant technological change during the 1990s. Further, the results point to a decreasing returns to scale in production. Results also suggest that a majority of the firms have low levels of technical efficiency and that the efficiency has not improved significantly over time. However, the growth of technical efficiency is observed in some firms in the engineering sector and many firms in the petroleum producing/selling sector.

Goldar (2004) has studied the productivity trends in pre and post reform periods in Indian manufacturing sector. This study makes a contrary view that Unel (2003) and TSL (2003). In the mentioned two studies it was shown that after reform the productivity growth increases but keeping the earlier stance of Goldar (2000), this study again shows that there is slow down in TFP growth in Indian manufacturing in the post-reform period and thus do not bear out the findings of the studies by Unel and TSL. The explanation for the slowdown in TFP growth in Indian manufacturing in the post-reform period seems to lie in the adverse influence of certain factors that more than offset the favourable influence of the reforms. Two factors that seem to have had an adverse effect on industrial productivity in the post-reform period are (a) decline in the growth rate of agriculture and (b) deterioration in capacity utilisation in the industrial sector.

Das (2004) has studied the manufacturing productivity performance under varying trade regimes during 1980 and 2000 using the Annual Survey of Industries data. The analysis focuses on the overall period of 1980-2000 and four sub-periods to reflect the shifts in trade policy regime. He found no evidence of much change in total factor productivity growth following liberalisation of the regime initiated in the early 1990s. The capital goods sector is the only one to register a positive growth (1.39 per cent per annum) throughout the period, the intermediate and consumer goods sectors both record negative growth in TFP during the entire period. The performance of the capital goods sector suggests that easing of quantitative restrictions on imports of machinery and spare parts has introduced external competition in the capital goods industries resulting in an improvement in productivity growth. Over all results
indicate that productivity performance seemed to worsen as the pace of trade reform gathered momentum.

Kim and Lee (2002) attempt to explore the patterns of technological learning among different strategic groups in the Korean Electronic Parts Industry. Primary data was collected from 115 SMEs in the Korean Electronic Parts Industry for the period of 1990-95 and a principal component analysis was performed in order to identify the structure and dynamics of strategic groups to examine the process of technological learning and to identify the influential factors. They identify four strategic groups: subcontractor, production focus, market focus, innovation and four influential factors: production capability, innovation capability, product line breadth and market breadth.

Three different evolution paths were identified based on a dynamic strategic group analysis, first, evolution from a subcontractor group into an innovator group by accumulating technological capabilities. The second path concerns those firms that move from a subcontractor group to a market focus group by simply adding products lines and customers. The third path involves SMEs that evolve from a subcontractor group into a production focus group by investing in production capabilities. Further in depth case analysis of five firms show close association between firms' evolution path and their technological learning processes.

Chuang and Lin, 1999, studied the spillover effects of Foreign Direct Investment and R&D on productivity of Taiwan’s manufacturing firms. They applied Heckman’s two stage estimation method on total factor productivity (TFP). Random sampling of 8846 establishment was taken from the Industrial and Commercial Census for Taiwan Fukien area, 1991. This firm was further classified as foreign-owned and domestic owned based on 15 percent shared in FDI. The study show that a one percent increase in an industry’s FDI ratio produce a 1.40 percent to 1.88 percent increase in domestic firms productivity, while a one percent increase in industry’s R&D intensity will generate a 19.1 percent to 41.7 percent increase in firms productivity. Furthermore, FDI, technology purchase, and outward foreign investment are substitute to R&D activity.

Berger N. Allen (1995), this paper studied the relationship between market-power (MP) and efficient-structure (ES) to explain the profit-structure relationship in banking by adding direct measures of both X-efficiency and scale efficiency to the empirical analysis. Tests of two MP and two ES hypotheses are performed by regressing profits against measures of concentration, market share, X-efficiency, and scale efficiency. Concentration and market share are also regressed against the efficiency variables to test the necessary condition of the ES hypotheses that efficiency effects market structure. The thirty large cross-sections data of ten years of the 1980’s on relatively homogenous industry were studied.

The empirical results indicate some limited support for two of the four hypotheses. The data provide partial support for the X-efficiency version of the ES hypothesis
(ESX). X-efficiency or superior management of the resources is consistently associated with higher profits, however support of other condition of ESX that X-efficiency is positively related to concentration or market share so that it can explain the positive profit-structure relationship, is much weaker. Market share is positively related to profitability in most cases after controlling the effects of concentration and efficiency, partially support the relative market power hypothesis (RMP). The data do not support the scale-efficiency version of the ES hypothesis (ESS) and the traditional structure-conduct-performance hypothesis (SCP). Scale-economy efficiencies which measure the benefits of being larger with the scale-economy region, is not positively related to either profit or market concentration and concentration is usually negatively related to profitability.

Porter, E. Michael presents a theory of the determinants of companies' profits which rests on the structure within industries as well as on industry-wide traits of market structure build on the concepts of strategic groups and mobility barriers. Further, in each industry firms was classified into two categories as leaders (accounting approximate 30% of industry sales revenue) and followers.

The correlation between rates of return of leading firms and follower firms in the same industry is strikingly low (0.14). Firms in the leader group are on average more profitable than those in the follower group (11.68% vs. 10.84%) while the standard deviation of leader group rates of return is greater. This modestly supports the notion that mobility barriers and rivalry determinants are generally more favorable in the leader group. Industry advertising is positively correlated with both leaders' and followers' profit. Growth and capital requirement are potent positive and significant influences on followers' profits. Concentration has a positive influence on leaders profits, and it is nearly statistically significant if it is interacted with the number of firms in the leader group.

Ariccia, Dell' Giovanni (2000), analyses the effects of informational asymmetries on the market structure of the banking industry in a multi-period model of spatial competition and show that asymmetric information and learning contribute to determine bank conduct and credit industry structure. They apply the symmetric Nash equilibria in location and interest rate.

The analysis show that asymmetric information and learning by lending give incumbent banks an advantage over potential entrants further, these informational asymmetries are important determinants of the industry structure and banks' strategic behavior. Contrary to traditional models of horizontal differentiation, the steady-state equilibrium is characterized by a finite number of banks regardless of the absence of exogenous sunk costs. Information barriers to entry are lower in economies that grow faster and on the other hand, barriers to entry are higher where informational asymmetries are more relevant. As a result, different degree may prevail on different segments of the market, as borrowers may be characterized by different degree of
asymmetric information. In addition, less concentrated industry structures may be associated with higher interest rates.

Lusch and Gene (1987), empirically examine the inseparability of the marketing concept and stakeholder concept. The study is based on the perception of Fortune 500 executives on their views concerning the business environment, organisational conduct and expected conduct in 1995. Structure equations with unobservable or latent constructs were used to test the hypotheses using the LISREL program of Jöreskog and Sörbom (1981).

Empirical evidence provided supports the marketing concept and stakeholder concept as representative of a single underlying philosophical business orientation. All the indicators of competitive intensity, the extended marketing concept and organizational performance are statistically significant with regard to their respective constructs. Increasing competitive intensity is associated with a stronger emphasis on the external marketing concept. Similarly an increased emphasis on the extended marketing concept is associated with increased organizational performance. Which shows that Fortune 500 executives believe that as their firms and industry face increased competitive intensity in the mid’s 1990’s they will place more emphasis on these philosophies. Further they believe that these philosophies will increase the performance of their organization in the mid 1990’s.

Bharadwaj, S. Anandhi, et al (1999), using Tobin’s q, analysed financial market-based measure of firm performance and examine the association between IT investments and firm q values, after controlling for a variety of industry factors and firm-specific variables. The IT spending figure representing the corporate wide capital and operating budget for information systems and services was collected for US IT sector for the five year period from 1989-1993. Least-squares regression was used to estimate the relationship between IT expenditure and Tobin’s q, while controlling for other firm and industry specific explanatory variable each year.

The results indicate that in all of the five years, the inclusion of the IT expenditure variable in the model increased the variance explained in q significantly. It also shows that for all five years IT investment had a significantly positive association with Tobin’s q value. These results are consistent with the notion that IT contributes to a firm’s future performance potential.

S. Chandrashekhar, K P Basvarajappa (2001), examine the trends in R&D expenditure indifferent areas between 1994-95 and 1999-2000 linking this expenditure with the economic importance of the areas. The study show that in most of the sectors expenditure in R&D has increased from 1994-95 to 1999-2000 like in defense, space and atomic energy, agriculture, bio-technology, health care and drug industry and information technology, while the share of industry to the total R&D expenditure went down. The analysis indicates that agriculture and mainstream industries are the major current drivers of the Indian economy. These are the areas where technology inputs can make globally more competitive.