



## *REVIEW OF LITERATURE*

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## **II. REVIEW OF LITERATURE**

The literature relating to the study is discussed under the following headings:

- A. Impact studies
- B. Studies relating to productivity
- C. Studies relating to efficiency of manufacturing sector
- D. Other related studies

### **A. IMPACT STUDIES**

Arya (1983) assessed the change in labour productivity consequent upon unit change in capital intensity (technology) for the period 1956-72 for 15 companies. The companies which showed significant shift were Acc, Madras, Travancore, Saurashtra, Sore Valley, Dalmia Dadri, Bangelkot, Andhra Cement, Panyam Cement and Mysore Cement. In case of individual companies, there was a significant association between capital intensity and labour productivity which was in conformity with the findings in case of aggregate analysis of capital intensity as a proxy for technical change had affected labour productivity favourably.

Panda (1996) studied the impact of changes on the government policies during the period from 1960 to 1989, on select automobile firms of India. The study found that the firms were benefiting from the economies of scale in production during the protectionist period. The result of the study revealed that Ashok Leyland Ltd Company, despite its lower volume of output, had achieved higher technical progress and there by registered high productivity growth during liberalization period.

Vivek Srivastava (1996) analysed the impact of India's liberalization policies of post 1985 on productivity and competition in Indian industry during 1980-89. The study found that the average Total Factor Productivity Growth (TFPG) rate was high during the post reform period. The TFPG rates ranged from 0-10 percent to 2 percent after the liberalization, where as it was negative

in the pre reform period .The study also found that the transport equipment industry had experienced a negative TFPgrowth during the period 1980-84 period. It had declined to-0.039 percent during 1985-89.The study did not find a fall in price-cost margins after the liberalization. The share of imported raw materials in the total raw materials used at the firm level increased by about 41 percent after 1985, relative to the pre 1985 period. Hence the study opined that high TFPG rates in some industries were due to the increased availability of imported intermediate inputs and better utilization of labour.

Byung, S. Min (1998) analysed the adverse effect from the constraints on competition both among domestic firms and from foreign firm in Korean manufacturing sector. The estimated results supported the direct and negative effects of trade restrictions on X-efficiency. Trade restriction would seem to have increased both the market power of domestic firms and wastage of resources both in 1986 and 1975. Quantitative restrictions were important variables to determine the level of X-efficiency in the mid 1970's when quantitative restrictions were relatively heavily applied by Korean government. The results provide a foundation for the privatization of public and regulated firms and macro economic reforms of competition policy in the international context.

Biman Chandra De (2000) analysed the effect of import substitution on the growth of Iron and steel industry. It sought to measure the effect of the policy of import substitution on the growth of iron and steel industry. It was found that the import substitution variable had a negative impact on the growth of the iron and steel industry.

Pulak Mishra and Ramakanta Prusty (2001) found that the period beginning 1981 marked a significant shift in the development perspective of the country. Since then the economy has become more diversified with an upsurge in the contribution of services and manufacturing sector. In the year 1999-2000, the industrial sector as a whole has growth at a rate of 7.0 percent per annum and the industrial production was 55 percent higher than what it was

in 1993-94. This is largely attributable to the manufacturing sector grown at an average rate of 7.5 percent with their respective weight of 79.36 percent.

Adeolo Adenikinju (2002) attempted to shed some light on the determinants of productivity growth in a sample of four countries namely Cameroon, cote'd Ivorie, Nigeria and Senegal. During 1980 and 1990 all studied countries experienced negative productivity growth on average. With regard to determinants of productivity growth human or skilled labour played an important role for productivity growth in Senegal. In Nigeria skilled labour and investment in education showed positive and significant impact on Total Factor Productivity (TFP). The ratio of high skilled workers to total labour had a positive and significant influence on TFP. Physical infrastructure, including roads, ports, energy production facilities or telephone lines showed significant TFP growth in Senegal but an insignificant impact in cote d' Ivorie. The estimation of production and export functions confirmed that productivity had a direct effect on exports along with the indirect effect it had on production volume.

Magnus Lindmark and Peter Vikstrom, (2002) in their article analysed "The determinants of structural change: Transformation pressure and structural change in Swedish Manufacturing Industry". The rate of structural change was estimated by using an angle measure and was then compared with the dispersion of Gross Profit Shares (GPS) between nine branches of Swedish industry. This dispersion of GPS was used as an indicator of the transformation pressure. A good correlation was present until the early 1950s, when a change in the relation ship between GPS dispersion and actual structural change was observed. Further more, they suggested that the change was in the relation ship may be understood either as the result of institutional factors affecting the resource allocation or as an outcome of growth itself, supported by the hypothesis that a higher capital intensity led to market concentration and natural barriers to entry, possibly reinforced by a higher degree of specialization.

Rashmi Banga (2004) examined the impact of Japanese and US Foreign Direct Investments (FDI) on total factor productivity growth of firms in the Indian automobile, electrical and chemical industries in the post –reforms period for the period from 1993-94 to 1999-2000. The results showed that Japanese affiliation has a significant positive impact on productivity growth in a firm while the impact of US affiliation was not found to be significant. Also domestic firms had witnessed both efficiency growth as well as technological progress in the electrical and chemical industries in the post -reform period.

Siddharthan and Lal (2004) analysed the impact of FDI spillover on the productivity of Indian enterprises for the post liberalization years 1993-2000. The study showed the presence of significant spillovers effects from FDI. During the initial years of liberalization, the spillovers effects were modest but later on increased sharply and stabilized towards the end. However, not all domestic firms gained equally from the spillovers. Domestic firms that possessed higher labour productivities and lower productivity gaps with MNE were able to enjoy higher spillovers while those with large productivity gaps could not benefit much .Consequently firms with endowments in terms of productivity and technology benefitted from liberalization and FDI presence. Firms with large productivity gaps became the victims.

Selvaraj (2007) analyzed the manufacturing industry at the all India level covering 24 years period from 1981-82 to 2004-05, to identify the effect of liberalization policy. The total period is divided in to sub periods, namely period 1 (1981-82 to 1990-91), period 2 (1991-92 to 2004-05) and over all period (1981-82 to 2004-2005). The growth of total factor productivity was mainly because of growth in labour productivity. The study suggested that to develop the country's manufacturing industry, we should increase the efficiency of input use, particularly capital.

Rajan et.al (2008) examined the productivity growth for two sub-periods, i.e., 1973-74 to 1992-93 (pre reform period) and 1993-94 to 2004-05(post reform period), for possible structural changes due to policy reforms.

As far as iron and steel industry is concerned, productivity growth has declined in the sub- period (post-reform period). Technological change during the 1990s was significantly slackened though it remained positive. On the other hand, Aluminum and Refined petroleum industries have maintained consistency in their productivity growth with out much volatility. It is worth noting that the productivity in recent petroleum products has continued to raise consistently inspite of two big oil crises and increasing cost of crude oil. Labour productivity for all the three industries showed a positive and significant trend. An implication of this finding is that the reason for the poor performance of iron and steel industry has to be sought in the inefficient utilization of factors of production, in particular under utilization of the labour input in accordance with the changing demand, together with sluggish growth in technological progress.

## **B. STUDIES RELATING TO PRODUCTIVITY**

Dhillon (1983) studied the productivity trends and factor substitutability in manufacturing sector in Karnataka from 1968-69 to 1977-78. The results showed that the total productivity increased till 1969-70 and after 1969-70 it declined continuously. The three year moving average first showed an increasing trend till 1969 then declined continuously overtime. The declining trend of productivity in the later period explained the fact that the supply of industrial skills had not kept pace with the increased demand. Elasticity of substitution was found to be not significantly different from unity. The elasticity of substitution reflects with the ease with which one factor can be substituted for the other. The relative price of labour increased, though it decreased in absolute terms. This suggested that the share of labour income relative to that of capital increased during the period of study.

Gupta (1985) attempted to examine the major productivity trends and factor substitutability in the manufacturing sector in Maharashtra. The period of study was from 1968-69 to 1977-78. The study found that labour productivity had been falling during the period while the capital productivity

had increased and capital intensity had fallen. The lockouts of industries in Maharashtra could also be accounted as an important factor for the fall in their productivity.

Islam (1990) analyzed labour productivity of cotton textile industry in Bangladesh. The firms established between 1950 and 1960 and those between 1961 and 1970 and 1971 and 1980 were selected. The study was concerned with plant level analysis based on 13 BTMC mills chosen from three categories of mills on the basis of their year of establishment applying stratified random sampling technique. A cross section study of a sample of 13 mills under nationalized management had been made. The variables namely man-capital ratio, equipments ratio of man hours lost to actual hours worked. The sizes of the enterprises were found to explain about 80 per cent of the variation in labour productivity.

Chandra Sekaran and Bhavani Sridharan (1993) for the period from 1973-1974 to 1986-1987 measured productivity in cotton textile industry in India. It was found that labour productivity in the cotton industry had increased at a higher rate than capital and contributed to the growth of output and efficiency achieved. Labour productivity had increased with an increase in capital labour ratio and capital labour ratio had increased mainly due to decrease in number of employees since 1983. On the other hand the correlation between capital productivity and capital labour ratio was positive but it was of low degree. Elasticity of output with respect to capital was found to be statistically insignificant where as the elasticity of output with respect to labour represented by the coefficient labour was significant at 5 percent level. Sum of the factor elasticities showed constant returns to scale in the industry. The co-efficient of Constant Elasticity of Substitution (CES) was positive and significant.

Ramaswamy (1993) for the period 1976-77 observed that partial factor productivities of labour and capital did not exhibit any significant relationship with employment and size of establishment. A positive relationship was

observed between capital labour ratio and investment size of establishment. Labour productivity rose with investment size of establishment while capital productivity fell with investment size of establishments. The relative efficiency was measured by an index of relative total factor productivity defined as a weighted average of labour and capital productivity with income shares as weights. The hypothesis constant returns to scale was rejected in all the four industries. The magnitude of economies of scale co-efficient was estimated to range from 0.03 in motor vehicle parts industry to 0.11 machine tools. The co-efficient was found to be similar in agricultural, machinery and plastic products, which was estimated to be 0.04. Firm size and total factor productivity were not found to be systematically related.

Rekha Shukla (1993) analysed the growth performance of Madhya Pradesh in terms of labour productivity, capital productivity, capital intensity and technological growth. The estimates showed that labour productivity had not shown any significant increase during the study period from 1977-78 to 1987-88. Capital productivity was found to be negative. The stagnant labour productivity and negative growth in capital in the industry revealed that the capital investment was not able to improve the productivity of labour. Expansion of capital reduced the productivity of capital because of diminishing returns on capital. The contribution of technology in output growth was negative. This supported the conclusion that the expansion of capital was not an indicator of technological growth in the industry. It had on the other hand failed to improve the growth of output.

Seshiah and Reddi (1993) examined the trends in productivity of some industries of Andhra Pradesh manufacturing sector for the period 1976-86. The total factor productivity measured by using the Divisia indices showed that the impact of technical progress was observed in cotton textile industry. Tobacco, beverages, paper and paper products industries exhibited technical retrogression. The food product industry also registered technological retrogression but it was found to be insignificant.

Dholakia and Dholakia (1994) in their study analysed the behaviour of Total Factor Productivity Growth (TFPG) in the Indian manufacturing industry overtime, particularly during the 80's as compared to 70's. It was found that the change in prices varied considerably across input groups not only during the 70's but also during 80's. The annual growth of real value added in the Indian manufacturing when measured through single deflation method showed remarkable acceleration during the 80's as compared to the 70's. If however, the same was measured through double deflation method the acceleration in the growth rate was found to be much higher during the 80's as compared to the 70's.

Upendranath et al. (1994) attempted a disaggregated analysis of growth and structure of the manufacturing sector at the district and industry levels for the period from 1967-68 to 1988-89. It was found that industries that have registered significant increase in productivity were rubber, plastic petroleum and coal products (9 per cent), other manufacturing (5 per cent), beverages and tobacco products (6 per cent), cotton textiles (8 per cent), chemical and chemical products (8 per cent) and wood and wood products (4 per cent). As far the remaining ones they averaged around 2 per cent. The output of most of these industries had also grown at a higher rate, confirming the validity of Verdoorn's law that there is a positive linear relationship between productivity and output growth. Most of these industries exhibited higher productivity, which was more due to use of more capital per employee. As far as movement across time was concerned, industries have either registered increases or remained constant, except basic metals and alloys industries which showed a tremendous fall. Output elasticities with respect to capital and labour, many industries showed relatively higher response to capital.

Sidhu (1995) studied variations in the level of factor productivity in the manufacturing sector in Gujarat for the period 1980-81 to 1990-91 by using Direct, Kendrick, Solow and Divisia method. It was found that Total Factor Productivity Indices (TFPIs) obtained through these methods registered

declining trend during the year 1984-85, 1987-88, 1989-90 and 1990-91. While the variation in the Solow Total Factor Productivity Index (TFPI) were in consonance with Total Factor Productivity Indices (TFPI's) obtained through other methods, it registered increasing trend during 1990-91 which was contrary. The Compound Annual Rate of Growth (CARGs) of Total Factor Productivity (TFP) during the decade 1980-91, recorded by different methods were 6.33 per cent in Solow, 2.40 per cent in Divisia and 2.37 per cent in both Kendrick and Direct methods. The total factor productivity in the manufacturing sector at all India level recorded steady growth during the decade 1980-91 except 1987-88, in which the Total Factor Productivity Indices (TFPI's) obtained through Kendrick, Direct and Divisia methods recorded downward trend. The Solow total factor productivity however recorded a steady growth throughout the decade of 1980-91. The Compound Annual Rate of Growths (CARGs) of total factor productivity recorded by different Total Factor Productivity Indices (TFPI's) were 8.19 per cent in Solow, 3.88 per cent in Divisia and 3.71 per cent in both Kendrick and Direct methods. The analysis revealed that the total factor productivity in the manufacturing sector was higher at the nation level compared to Gujarat state.

Shyam (1995) made an attempt to analyse productivity performance of 3-digit industries for period 1974-76 and 1985-87. It was found that the level of productivity had been significantly higher in developed than that in developing countries. The average productivity in developing countries has only been around one fourth in 1974-76, which further fell down to less than one fifth during 1985-89. The major cause for deterioration in productivity during the period 1974-76 was higher wage rate in association with profit margin. In 1985-87, a higher profit margin has been found as a more crucial factor for explaining low level of productivity in developing countries.

Hina sidhu (1996) measured factor productivity and output elasticity over the period 1980-81 to 1990-91. Based on ASI factory sector data it was found that the index of capital productivity for all manufacturing industries showed a decline. The index of labour productivity recorded a positive growth

in all the industries. Factor productivity in the census sector showed that while labour productivity registered appreciable growth, capital productivity showed only marginal increase. There was almost one-to-one correspondence between the capital intensity and value added in most of the industries.

Baghel and Pendse (1996-97) examined the productivity trends and technological change in total manufacturing sector of India for the period from 1973-74 to 1989-90. On the basis of overall analysis it was found that labour was major source of output growth. The time trend co-efficient was found insignificant in most of the cases and suggested influences in favour of technological retrogressions. In other words, the manufacturing sector have not experienced technological change which was evident from the total factor productivity growth indices as well as parameters of time variables in the production. Excessive doses of capital have not resulted in technological progress as the capital intensity is increasing all time.

Yean (1997) attempted to measure total factor productivity growth for Malaysian manufacturing sector for the period 1986-1991. It was found that Malaysian manufacturing sector was still at the stage of being dependent on input growth rather than productivity growth during 1986-91. This was due to relatively low R & D expenditure in Malaysia, the determinants of technical change remained unknown. Dhananjayan and Sasikaladevi (1998) estimated total factor productivity growth (TEPG) indices for 18 Indian two digit manufacturing industries and analysed the emerging behavioural characteristics for the period from 1973-74 to 1993-94 using Kendrick, Solow and Divisia indices. The three magnitude and behavioural characteristics of the three total factor productivity estimates have tended to confirm marked degree of differences across the two-digit industry categories during the study period. The implication was that the extent of efficiency accomplished by the different industrial manufactures towards harnessing the maximum attainable growth rates in output has been industry specific in the Indian condition.

Subash C. Kumar (2000) attempted to estimate the growth of productivity in Indian leather industry and its major sectors tanning and footwear on the basis of Kendrick, Solow and Divisia indices. The study covered the period from 1974-75 to 1992-93. The study showed inter sectoral differences in productivity trend while TFP in tanning sector have been rising insignificantly. TFP in footwear sector have been declining significantly according to all three indices. For the industry factor productivities have been declining. In case of sectors as well as the industry, the partial labour productivity and capital intensity have been rising. Partial capital productivity on the other hand has been declining. Growth of capital deepening was found more in footwear sector followed by the industry and tanning sector. A positive and statistically significant relationship was observed between TFP and value added in both the sectors and the industry. It indicated change in scale production which had a positive contribution to the variation of TFP. A negative and significant relationship between proxy variables for management labour relations with TFP revealed that growth of TFP could have been much higher with a better management.

Tarlok Singh (2000) analysed total factor productivity (TFP) in the manufacturing industries in India. The study used annual data from 1973-74 to 1993-94 for a sample set of ten industries in the manufacturing sector. The results showed that the TFP recorded improvements in all the sample industries except for the basic metal industries in which the TFP witnessed a declining trend during 1973-74. The highest growth in TFP was observed in the case of food products followed by transport equipment, metallic products, electrical machinery, non-electrical machinery, the wool and silk textiles, chemical and jute textiles. He concluded that the policy initiatives adopted by the government changed a more conducive and competitive environment in the economy and would have favourable effect on the total factor productivity.

Biswanth Goldar (2001) analysed econometrically the relationship between technology acquisition and productivity growth in 82 large chemical

firms in India for the years 1985-1986 to 1989-90. The results of the study showed that R&D efforts of the firm had a significant favourable effect on productivity growth. On the other hand the results indicated that technology imports did not make a significant growth. Export intensity, firm size and intermediate goods, import intensity were significantly positively related with productivity growth.

Hay (2001) analysed the effects of the 1990 Brazilian trade liberalization of the total factor productivity, market share and profit of a sample of 318 large manufacturing firms for the period 1986-94. A very large total factor productivity gains in the period of 1994 was found which had accompanied by large falls in market shares and profits. The market share did not vary in the period up to 1990, but thereafter it declined year after year to 1994. An average of 12 period falls in market share in 1990 had grown to 30 per cent relatively. More efficiency firms had larger market share with an elasticity of 1.46. The difference in co-efficient was equivalent to a 65 per cent decline in average profit. The elasticity of profits with respect to efficiency was 0.8. The labour productivity in the Brazilian manufacturing sector suddenly began to grow at a rate of 7.35 per cent per annum in the year 1991-95. He suggested that the leading Brazilian manufacturing firms responded to trade liberalization after 1990 with an impressive growth in productivity, though some of that growth also represented the effects of general liberalization of the economy and on recovery from the adverse effects of the policy induced recession of 1990-91.

Sunil Kumar (2001) aimed at explaining the inter-state variations in the TFP in Indian manufacturing sector utilizing various socio economic variables for the period 1969-95. A significant slow TFP growth had been observed in Indian manufacturing sector. At disaggregated levels, considerable variations in TFP had been noticed. Industrially developed states experienced either a decline or low growth in TFP. The number of states that experienced a negative growth in TFP during intensive liberalization phase stood at seven against the two in the mild liberalization period. TFP growth was positively associated

with the degree of urbanization and growth of infrastructural facilities. The higher bureaucratic control and worsening industrial relations due to increase in manday lost per employee hinder the TFP growth. No evidence had been noticed about a significant positive relationship between output growth and TFP growth in Indian manufacturing sector.

Soumyendra Kishore Datta (2001-02) analysed partial productivity as well as wage productivity nexus in the mill sector for the period from 1966-67 to 1990-91. It was found that capital intensity changes had a greater impact on changes in labour productivity ratio where as the rise in percapita emoluments, reflecting increased well being of the employees, although had a positive influence on changes in labour productivity could not make a significant impact with regard to the movement of capital productivity. There was a more or less increasing trend till 1979-80, but there after gradually declined till 1988-89 with a slight recovery in the remaining two years of the last two decades. Labour productivity in cotton mill industry had out stripped the rise in capital productivity and contributed to the growth of output and total factor efficiency achieved. Factor productivity increases were largely due to increment in labour productivity.

Deb Kusum Das (2004) examined the productivity performance of Indian manufacturing under varying trade regimes for the over all period of 1980-2000. It was found that total factor productivity growth of 0.08 percent per annum averaged over 75 three-digit industries for their entire period. The total factor productivity growth rates for individual industries were either negative or in the 0 to 2 percent range. The capital goods sector was the only one to register a positive growth. TFP growth in the 1990's was found to be lower than in the 1980. In addition, for all three use-based sectors (intermediate, consumer and capital goods) TFP growth in the second half of the 1990's (1996-2000) was lower than in the first half (1991-95).

Jayamalathi and Manonmani., (2004) undertook a study on productivity in selected Manufacturing Industries in Tamilnadu for the reference period

between 1979-80 to 1997-98. The major objectives of the study were to study the trends, growth rates and magnitude of variability in factor productivity, to estimate production function, to analyse the returns to factor input including time variable and, to estimate certain important ratios. It was found that labour productivity in all the three industries (viz., Basic chemical and chemical products, Rubber, Plastic, Petroleum and Coal products and Non-metallic mineral products) had increased. The increase may be due to lots of factors such as capital intensity, economies of scale, growth of industry and work environment. Capital intensity which has increased significantly in all industries seems to be major factor behind the increase in labour productivity. The share of capital in total factor input has been increasing and that of labour is decreasing in all industries.

Mukherjee (2004) in his paper analysed the growth dynamics of the Informal Manufacturing Sector (IMS) in India over the period 1984-2000 and also made an attempt to identify the plausible factor determining the growth pattern. The informal manufacturing sector had seen a flurry of research activities over the last few years. It was found that the growth pattern of informal manufacturing sector had changed significantly from the pre-reform period to post-reform period. It had provided employment to a substantial number of jobseekers especially in the post-reform period. It had expanded substantially to compensate the slackening employment opportunities in the organized sector. The growth oriented activities (i.e.) non metallic mineral products, basic metal, transport equipment, beverage and rural basic chemicals and metal products sector were also exhibiting positive employment growth in most as well as at the national level in the post-reform period indicating that they are the dynamic sector.

A postalos Bankekas (2008) analyzed "multifactor productivity in the Swedish construction industry under imperfect competition". It was found that sustainability between capital and labour and materials, the returns to scale were found to be increasing, while introduction of new technology was found

to reduce the total cost of production. Finally on average, the Lerner index amounts to 15.1 percent per annum suggested that the Swedish construction industry possesses some monopoly power in the market for its product. This result also suggested that the results from cost function analysis, not taking the possibility of market power into account, might be biased due to misspecification of the model.

Gayathri and Manonmani (2008) undertook a study on productivity, employment and wages in the aggregate manufacturing sector of India for the reference period between 1990-91 and 2004-05. The major objectives of the study were to analyse the partial and total factor productivity trends, find out the sources of productivity change, examine the relationship existing between wage and productivity and analyse the trends in distribution of productivity gains. The study found that capital productivity had either declined or stagnated to mean that capital requirement per unit of output had increased and in future, increase in the output would require more and more increase in capital investment. The total factor productivity had increased significantly, increase in total factor productivity implied that over all efficiency of the sector was increasing, capital intensity had increased significantly in the sector, which implied that more and more capital is required for increasing employment, growth in value added had significantly and positively related to the productivity. The share of labour in total factor input had been declining. This indicated a trend of more mechanization and capital labour substitution in the industries, the relative factor price of labour had increased in the periods where its share in total input had decreased. The movement of wages was positively related with labour productivity. Wages and labour productivity seems to be related to trends and movements but they were not related magnitude and level wise. However, the comparison of their trend rates showed that labour productivity had increased at a faster than wages. The factor share in output had been changing overtime and declining. This implied that hypothesis of constancy of shares does not hold good in Indian manufacturing industries.

Gomathi and Manonmani., (2008) undertook a study on “Performance of Manufacturing sector of Tamilnadu in the Pre and Post Liberalization period”. For the reference period between 1979-1991 (pre-liberalization period) and 1991-2003 (post-liberalization period). The major objective of the study were to analyze the partial and factor productivity trends in the pre and post-liberalization period, find out the sources of productivity change in the pre and post-liberalization period, examine the relationship existing between wage and productivity in the pre and post-liberalization period and post – liberalization period, analyze the trends in factors share in the pre and post liberalization period. It was found that labour productivity had increased in the manufacturing sector of Tamilnadu. This implied that labour productivity in an industry can be increased by a host of factors such as capital intensity, economies of scale, growth of industry, and work environment. Capital intensity seems to be major factor behind the increase in the labour productivity. The total factor productivity had increased in both the periods, implying over all efficiency of the sector.

Manjappa and Mahesha (2008) analyzed “Productivity Performance of selected capital –intensive and labour – intensive industries in India during reform period: an empirical analysis”. The Total Factor Productivity growth was estimated by applying ratio form of Cobb-Douglas (C-D) production on the panel data of 10 manufacturing industries by classifying them in to capital-intensive and labour –intensive industries for the period 1994 to 2004. The investigation revealed that four out of five industries in capital – intensive segment showed productivity growth during the sample period, while one has recorded no change. A somewhat contrasting picture was observed for labour-intensive sector, where productivity decline is statistically significant in three industries and negative but not significant in two other.

Rajan et.al, (2008) analysed “Total Factor Productivity in Selected Indian Manufacturing Industries”, at the 3-digit level NIC classification, over the period 1973-74 to 2004-05. The study examined the productivity growth for

two sub-periods, i.e., 1973-74 to 1992-93 (pre-reform period) and 1993-94 to 2004-05 (post-reform period), for possible structural changes due to policy reforms. As far as iron and steel industry was concerned, productivity growth has declined in the second sub-period (post-reform period). Technological progress during the 1990's was significantly slackened though it remained positive. On the other hand, aluminium and refined petroleum industries have maintained consistency in their productivity growth without much volatility. It was worth noting that the productivity in refined petroleum products has continued to raise consistently inspite of two big oil crises and increasing cost of crude oil. Labour productivity for all the three industries showed a positive and significant trend. An implication of this finding was that the reason for the poor performance of iron and steel industry has to be sought in the inefficient utilisation of factors of production, in particular under utilisation the labor input in accordance with the changing demand, together with sluggish growth in technological progress.

Uppender and Sujjan (2008) analyzed the “Co integration between labor productivity and wage rates: empirical evidence from the Indian industries”, during the period 1980-81 to 2004-05. The empirical results based on unit root tests, co integration and error correction modeling exemplify that labour productivity and money wage rates were cointegrated showing the existence of Long run equilibrium between them. The elasticity of labour productivity with respect to money wage rate, was slightly more than unity in the long run revealing that the substitution possibilities of labour for capital in the Indian industries are more in the long run. As the substitution possibilities of labor for capital were more in the long run, the policy decision to enhance the money wage rate by one percentage would improve the labour productivity, on average, by more than one percentage in the Indian industries.

Vani Arora and Parminder Singh, (2008) in their article attempted to study “Economic Reforms and Productivity Growth in Indian Manufacturing Sector: An interstate Analysis”, for 16 major states of India for the period from

1973-74 to 2001-2002. The investigation revealed that there was fall in the growth rate of total factor productivity in the post-reform period, i.e., economic reforms have negatively affected the total factor productivity of Indian manufacturing sector. The decomposition analysis of Malquist productivity index showed that the most significant factor affecting the productivity index in the post-reform period was the declining technical efficiency. At the same time, the effect of the reforms has also been uneven across the states. In fact the states with higher growth rates prior to the reform have experienced less improvement than those with lower growth rates.

### **C. STUDIES RELATING TO EFFICIENCY OF MANUFACTURING SECTOR**

Jaiswal and Thakar (1982) analysed the total factor productivity data for the organized industrial sector in India. The efficiency of industrial units which produces non-electrical machinery has gone down by 15 percent during 1961-1966. Again, it decreased by 25 percent during 1966 to 1970. It registered an increase of 26 percent in the last phase of the period under study. The efficiency of large industrial sector of Gujarat state had decreased by 36 percent from 1961 to 1966 and increased by 6 percent from 1970 to 1974. The efficiency of textile industry has increased considerably from 1970-1974. In the year 1974, this industry has contributed nearly 48.45 percent in the corresponding net value added.

Arya (1985) while calculating elasticity of substitution of all Indian cement companies for the period 1951-60, 1961-70 and 1951-70 found that the period 1951-60 wage increase per man-hour (W/L) had favourable effect on labour productivity. Similarly, increase in capital per man-hour also increased labour productivity. The labour productivity had also increased over time. The elasticity of substitution was less than unity. For 1961-70, increase in wage rate per man-hour had unfavorable effect on labour productivity, but when it was taken along with increase in capital per worker, it had favourable effect. There

was increase in capital per worker, it had favourable effect. There was increase in labour productivity over time. The elasticity of substitution was negative.

Bhatia (1990) studied changes in productivity during 1965-1985 in India in relation to that in the UK and the USA .A Comparison of the productivity indices amongst the three countries revealed that in U.K, the productivity index rose during 1965-1973. It was stable during 1973-1982 and increased between 1983 - 1985. In the US, the productivity index had been rising steadily over the entire period 1965-1985. The index increased from 92 in 1965 to 100 in 1975 and further to 124 by 1985. In India total productivity declined during 1965-75. The index rose during the period 1975-85. The rise was steep during 1980-85. In India, rise in the productivity index after 1975 was higher than that in the U.K. It was higher than even that in the US after 1980. In India, though the total factor productivity during 1975-85, grew at a rate faster than that in the UK, and the US, a cross country comparison revealed that productivity in India was much lower than these two countries.

Ishaq Nadiri and Theofanis .P. Mamuneas (1994) examined the effects of publicly financed infrastructure and R&D capital on the cost structure and productivity performance of twelve two-digit US manufacturing industries from 1905-60 to 1980-86. An average cost function was specified. The results suggested that there were significant productive effects from these two types of capital (R&D). Their effects on the cost structure varied across industries. The public infrastructure capital affected the cost and productivity of the private sector industries. The magnitude of these effects were however much smaller. Other types of publicly financed capital such as public investment in R&D significantly affected the cost and productivity of different industries and had high social rate of returns.

Natsuki Fujita (1994) estimated TFPG rates for Indian manufacturing industries for the period between 1981-82 and 1987-88. The study found that liberalization improved productivity. TFPG rates of Labour - intensive industries were found to be higher than those of capital intensive industries.

Hence liberalization tends to exploitation of comparative advantage. The study also opined TFP growth resulted in more industrial exports from India.

The Industrial credit and investment corporation of India (1994) estimated the productivity trends in the private corporate firms of the Indian manufacturing sector during the period between 1972-73 and 1991-92. The results of the study showed negative productivity growth rates during the period between 1972-73 and 1986-87, and positive TFPG rates for the period between 1987-88 and 1991- 92. An average growth rate of -2.72 percent during 1972-73 to 1976-77, -2.75 percent during the period between 1977-78 and 1981-82, -0.88 percent during the period between 1982-83 and 1986-87, finally become 2.06 percent during the period 1987-88 and 1991-92.

Deepak Gupta (1995) analysed partial and total productivity trends in Indian capital goods industry and its three sub groups viz non-electrical machinery, electrical machinery and transport equipment covering the period 1973-74 to 1987-88 .It was found that there was continuous decline in capital productivity in all the three sub-groups of capital goods industry together with the continuous increase in labour productivity and capital intensity indicated that capital deepening was yet to reflect capital efficiency. Negative total productivity growth was recorded by non-electrical machinery group in the latest period (1981-82 to 1987-88). This called for increasing the efficiency of resource use, particularly of capital in this subgroup, as this subgroup (comprising manufacture of various types of machinery) constituted the prime mover of industrial growth in Indian economy.

Haishun et al (1999) in their study made an attempt to study the efficiency of industries in a transitional economy of China using data for 28 manufacturing industries across 29 provinces. The degree of economic openness of the Chinese economy, as measured by the sum of exports and imports as a share of GDP, has increased from 9.8 percent in 1978 to 35.7 percent in 1996. The savings were most apparent in the textile, timber processing and non –ferrous metal industries where on average output could be sustained at current levels while at least halving the quantity of resources used.

Shastri (2000) evaluated the influence of output, product wage, productive efficiency and labour market rigidities on employment in organized Indian manufacturing industry in the period 1950-94. The study found a near unity output elasticity on employment. The output grew by 8 per cent per annum during the period. However the growing output failed to pull employment at the same rate inspite of a near unity output elasticity of employment. The principal reason for the employment growth gap in the period seems to have been declining industrial efficiency. The growth in product wage seems to have contributed only in a minor way to the slow growth of employment with an average contribution of 0.7 per cent per annum. The output elasticity of employment was estimated to be much higher than the product wages elasticity of employment. A low level of elasticity of substitution between inputs with 95 per cent confidence interval ranging between 0.04 and 0.045 was observed. The estimate represented an average for the period and rejected both the fixed and Cobb-Douglas forms of production function. The hypothesis of constant returns to scale was not ruled out by the study and point estimates of the return to scale parameters ranged between 0.88 and 0.94.

Singh (2000) studied the productivity efficiency of 21 State Road Transport Undertakings (STUs) in India over 1984-85 to 1996-97. It was observed that there were wide disparities among state road transport undertakings according to their productive efficiency levels and growth. On average small-sized state road transport undertakings experience higher level of productive efficiency than their large counterparts. And by and large Tamil Nadu state road transport undertakings seem to be more productive than their counter parts operating in other states of the country. The average annual growth of productive efficiency ranged from 2.39 per cent to 4.41 per cent. The distribution of ranks of state road transport undertakings with respect to their productive efficiency level has remained broadly unchanged over the year.

Susan J Linz (2000) estimated industry wise and regional differences in labour productivity in Russian industry at the beginning of the transition from a planned to a market economy for the period 1992. It was found that firms with below -industry – average labour productivity was expected to experience a higher than average reduction in work force size. Spinning, machine –building, forestry, wood, paper and construction materials industries ranked lowest in terms of labour productivity. Labour productivity in the Ural, Western Siberia and Black Earth Regions was significantly below that of firms in the Volga region.

Chidambaram and Muthukrishnan (2003) made an attempt to measure the operating efficiency in terms of productivity of Madras Cements and India Cements, the two major cement companies in Tamil Nadu for the study period 1990-91 to 2001-02. The study used three ratios namely overall productivity, selling, distribution and administration, productivity and labour productivity. The overall productivity indicated that Madras Cements performance was outstanding than India Cements. In the area of selling, distribution and administration and productivity, the Madras Cements performance was commendable. Martly's F-max applied to determine whether the three areas of productivity had any difference or not showed that difference were found in variance of Madras Cements.

Mitra et al. (2003) examined the effect of in infrastructure on manufacturing industries Total Factor Productivity (TFP) and Technical Efficiency (TE) in case of Indian states for 15 industries from 1976-92. Consumption goods industries showed constant returns to scale whereas heavy industries showed decreasing returns to scale. Light industries were less capital intensive than heavy industries. The productivity growth differences showed that Indian heavy industry exhibited a higher growth potential in terms of total factor productivity than did light industry. The impact of infrastructure on long run productivity by manufacturing industry showed the greatest impact on industrial total factor productivity growth. The second item of importance was financial development. The impact of financial development on total factor

productivity was more significant since the country was long subject to a controlled financial policy regime that hindered the development of savings. There existed significant difference in technical efficiency among states which was partly attributed to difference in physical, economic and social infrastructure.

Golder et al. (2004) analyzed the effect of ownership on efficiency of engineering firms in the 1990s, a decade of major economic reforms. Technical efficiency of firms were estimated with the help of stochastic frontier production function for three groups of firms namely (i) firms with foreign ownership, (ii) domestically owned private sector firms and (iii) public sector firms. The results clearly indicated that foreign firms in Indian engineering industry have higher technical efficiency than domestically owned firms. There were indications of a process of efficiency convergence (i.e.) the domestically owned firms tending to catch up with foreign owned firms in terms of technical efficiency. In the first half of the 1990s there were significant positive productivity spillover effects from foreign owned firms. This effect became relatively less important in the second half of the 1990s when access to imported inputs became an increasingly more important source of efficiency of engineering firms in India.

Ray (2004) examined the changes in competitiveness of Indian manufacturing firms through increased efficiency over the period 1991-01. The firm level efficiencies had been calculated using data from 27 industry groups and using the Data Envelopment Approach (DEA). It was found that ownership of domestic firms by MNE's clearly helped in enhancing the efficiency of these firms. Developing countries had progressively adopted market friendly reforms during 1980s and 1990s. Productivity spillovers took place when the entry or presence of MNE's affiliates leads to efficiency benefits for domestic firms. There was clear scope for more reforms that can make the process less dependent on foreign firms and encourage in house development of more efficiency ways of production.

Sunil Kumar and Nitinarora (2007) in their article analyzed “Technical and scale efficiency in Indian, manufacturing sector”. A cross-sectional analysis using deterministic frontier approach”. The mean of overall technical efficiency (OTE) scores has turned out to be 0.603 (with standard deviation of 0.177) and OTE score range from a minimum of 0.345 to a maximum of 1. The major findings of this study was Indian manufacturing sector, on an average, 39.7 percent of resources were being wasted in the production process. Only 9 industrial groups attained the status of globally efficient groups with OTE score equal to 1. The decomposition analysis of OTE score into its two mutually exclusive non additive components viz., pure technical efficiency (PTE) and scale efficiency (SE) delineate that 31.2 percentage points of 39.7 percentage of over all technical in efficiency (OTE) was due to inappropriate management practices being adopted by firm’s managers in organizing the inputs in the production process. The remaining part of the OTIE was due to the firms not operating at optimal scale size. Further, it was observed that 62 percent of groups are operating at above their optimal size and thus, experiencing decreasing returns-to-scale. The result of Tobit regression analysis revealed that the proxy variables for capital deepening, profitability and degree of skill formation have a positive impact on the OTE of Indian manufacturing sector.

#### **D.OTHER RELATED STUDIES**

Babu and Vani (1983) made an attempt to estimate the CES function for the Indian manufacturing sector at constant prices for input and output for the two periods 1949-58 and 1959-66. As far the distribution parameter, meaningful estimate was obtained only for the period 1948-58. The CES function has been particularly useful in throwing light on served aspects which one would not have been able to observe if the Cobb-Douglas function has been used.

Kim (1984) analysed CES production function for two-digit manufacturing industries in Korea across different size groups. The estimates

of the co-efficient of production function showed that the elasticity of substitution between capital and labour were substantially different from zero in all industries except wood products and non-metallic industries and in both small and medium groups.

Dhesi and Malhotra (1985) found that the sources of foreign direct investment have widened with the entry to smaller developed countries and relatively developed countries in the field. The concentration ratio for each industry was computed by using the detailed information available in Kothari's Economic Guide and Investors Hand Book of India. It was found that the co-efficient for R and D expenditure was significant and positive.

Purohit (1988) analyzed changes in the structure of manufacturing sector in India during the period 1951 and 1970. The structure of manufacturing sector in India during 1951-58 was such that the output in manufacturing sector had shown higher growth as compared to employment. The output had increased with five per cent rate of growth per annum whereas employment had increased with one per cent per annum. Growth in output was more consistent than the employment. This shows the higher output labour ratio. During the period 1961-1970, the rate industrialization was relatively high as compared to the earlier period output which had witnessed three times higher rate of growth. Thus, the trend of industrial growth since 1950's suggested that the period was characterized as a period of slow rate of growth of industrialization as compared to 1960s during which new technology was acquired, new variety of product was developed and industrial growth was also increased.

Reddy and Reddy (1989) wanted to specify the inverse labour demand equations by applying CES production function for the period 1947-77 for some selected industries such as cement, cotton textiles, glass and glassware industry, iron and steel, jute textiles industry, matches industry, paints and varnishes industry, tanning industry and woolen textile industry. In each industry the labour demand equation based on CES production function appeared to be reasonable. The elasticity of substitution in each industry stayed well below unity indicating the rigidity of capital labour substitution.

Abdulkadhim et al. (1990) studied the role of manufacturing sector in the Iraqi economy for the period 1960-74 and 1977-78. The result revealed that the average rate of technical change increased with time. The contribution made by technical change increased from 43.5 per cent during the first period and 20.9 per cent during the last period. The capital input was the main contributor to the growth of output, while labour's contribution was comparatively low. Labour's contribution was less than 20 per cent while that of capital was higher than 50 per cent. The low contribution by labour might be attributed to the full employment strategy, which resulted in employing more labour than was actually needed.

Yang et al. (1994) investigated price behavior in Korean manufacturing sector. The objective was to see whether price behavior in the domestic and export markets were distinctly different in the pass-through of exchange rate into export and domestic prices. The data was collected for the period 1976-90 for six manufacturing sectors. He found that manufacturing firms in Korea had pursued one pricing strategy in the export market of selling at the competitive world prices in the domestic market. The market power allows them to engage in price discrimination by charging significantly higher prices. The end result of such pricing strategy was for domestic consumers of manufacturer to subsidies export activities.

Chattopadhyay and Bhadra (1997-98) investigated the state of manufacturing production for some two-digit industries in West Bengal prior to India's current economic liberalization reforms, which started in the 1990s. It was found that the elasticity of substitution parameters was significantly different from zero and a return to scale parameters was greater than one. These could have provided considerable leverage in policy at this period.

Pandey et al. (1998) studied about three digit census factories under registered manufacturing sector of India for the reference period viz., 1965-66 to 1989-90. The study revealed that instead of wage, the elasticity of K/L ratio become a critical co-efficient to signify the greater or smaller degree of labour productivity. In other words it implies that management and technology has

assumed to be crucial explanatory variables of the growth of labour productivity in the census-manufacturing sector.

Swamy (1999) presented the efficiency of Indian manufacturing sector in terms of employment generation. It was found that output had grown at the ratio of 2.96 per cent per annum in Indian manufacturing industries during the period of 1980-84 while capital investment had increased at the rate of 3.9 per cent per annum. On the other hand employment had grown at the rate of 0.47 per cent for the entire study. Growth in capital was also associated with technological advancement which reduces labour employment. This view is supported by size effective analysis where output had shown positive and very significant impact on investment generation. Indian manufacturing sector experienced abnormal increase in real wages during the study period, which might have reduced employment. Increased wage will reduce profits and hence entrepreneurs go for substituting capital for labour.

Nagaraj (2000) analyzed the employment growth in organized manufacturing sector over the period 1973-74 to 1997-98. The relationship existed between employment, wage and value added were found to be statistically significant. On the contrary the jobless growth in 1980s registered manufacturing employment growth annually at about three per cent during 1991-97. The annual growth rate of earning per worker declined from 4.8 per cent in the 1980s to 2.5 percent in the 1990s.

Dipak Majumdar and Sandipsarkar (2001), analyzed "Reforms and Employment Elasticity in organized Manufacturing". Three periods may be distinguished showing large variations in employment elasticity in Indian manufacturing. The first period (1974-80) with an elasticity close to unity, the second (1980-86) with a negative employment elasticity ('jobless growth'), and the third (1986-96), the ('reform period') when employment started to recover along with an enhanced rate of growth of output, although employment elasticity did not reach the levels of the first period.

MD. Shan Alam (2001) analysed the “cost and profitability of a public sector paper mill”. The study suggested that monthly variance of material used, labour costs and overheads expenditure should be prepared to control cost and improve profitability

Syed Mohammed Athe (2001), in his study, examined the “Profitability of public industrial Enterprises in Bangladesh”. Profitability of sample enterprises at shadow prices was higher than the prevalent bank rates of interest. So the performance was not poor during study period. The inefficient use of working capital and fixed capital booth seemed to contribute greatly to slow decreasing trend of public profitability at constant shadow prices.

Burange (2001-02) attempted to analyses import intensity of manufacturing sector over the periods of 1978-79 to 1997-98. An attempt was also made to identify the industries which have high import intensity, export intensity and their contribution to foreign exchange earning. It was found that the agro based, chemical based and non-metallic mineral based industries experience a fall in the import intensity. Only metal-based industries recorded a rise in import intensity during this period.

Hay (2002) analyzed the degree of change in productivity through changes in the level of production across different sectors. The period chosen for the analysis covered between 1984 and 1991. It was found that labour productivity in the Brazilian manufacturing sector had grown at a rate of 7.35 per cent in the period 1991-95. This period of productivity growth included two different phases. In the first phase, upto 1992 there was a deep recession with output falling, but employment falling even faster. In the second phase, after 1992 productivity and output grew, but former grew faster to employment at a lesser rate than in 1990-92. There was a marked fall in 1990, followed by rapid growth to 1994. The coefficient suggested a cumulative growth in total productivity of 58 per cent from 1990-94.

Rao et al. (2003) study aimed at assessing the efficiency of the industrial sector in Maharashtra. In 11 industries, the share of capital in the total output

has showed a tendency to increase after the firms. The study used the total factor productivity method for measuring efficiency; Direct method, Domer Index, Kendrick Index, Solow Index and Translog method. The study found that the transport equipment industry had experienced a negative total factor productivity growth during the period 1980-89.

Lakhwinder Singh (2004), examined the impact of R and D and both domestic and international technological diffusion on productivity growth, using panel data for 28 Korean manufacturing industries over the period 1970-2000. The empirical analysis confirms earlier evidence relating to advanced countries that R and D investments were positively related to productivity at the industry level. There was also evidence that productivity growth of an industry also benefits from other industries research and development efforts. To distinguish the importance between different channels of domestic and international technological knowledge diffusion. They used import impacted and technology matrix weights for domestic and international knowledge spillovers specification performed quite well implying that the trade is the dominant channel for the diffusion of technology both domestically and internationally. However the sub-period empirically evidence endorses this finding only for the two-sub periods, that is, 1970-79 and 1980-89. The empirically evidence for the 1990's did not land support to the diffusion through trade. This finding from the empirical analysis was clear pointer towards the fact that when the nature of knowledge becomes more and more complex and tacit, trade no longer seves as a good carrier of technological knowledge transfer. This finding from the 1990's empirical analysis had severe implications for the strict intellectual property rights regime imposed by the world trade organization.

Suresh Chand Agarwal, (2004) in their article analysed "Labour Quality In Indian Manufacturing A State Level Analysis". It was found that manufacturing workers are more literate today than they were in 1983. It also presents a labour quality index based on the Jorgenson, Gallop, and Fraumeni

methodology for both the rural and urban sectors of the states. The labour quality indices show that quality changes have been quite slow and there was a lot of variation among states in both the rural and urban sectors. The association of the labour quality index has stronger links with the human development index of the states, urban poverty ratio of the state, number of ITIs and the intensity of industrialization.

Azman.H et.al, (2008) in their article analysed “Markup and Market Power in the Malaysian Manufacturing industries”, for the period of the study 1974 – 1996 3-digit Malaysian manufacturing industries, using cross-sectional data. The result indicated that most of the Malaysian manufacturing industries at 3-digit level have considerable market power, and are thus in need of a competitive policy to check the abuse of market power.

Sumonkanti Das, et.al, (2008), in their article analysed about industrial growth of some manufacturing industries in Bangladesh using Census of Manufacturing Industries (CMI) data from the years 1981-82 to 1999-2000 and found higher increasing growth in value added for some industries in the post-liberalization period (1991-92 to 1999-2000) while for the most important industries, satisfactory growth level in the pre-liberalization period (1981-82 to 1990-91). Capital goods industries showed highest significant annual growth rate (13.95 percent). All manufacturing industries registered positive and negative employment elasticities with respect to value added and fixed capital whereas only positive output elasticities with respect to fixed capital and employment for the same.

Binoy Goswami, (2009) analyses “The Performance of Foreign Firms in the Indian Manufacturing Industry”, starting from 1991-2006. It was found that at the aggregate level, the specific warranted effects of FDI associated with the performance of foreign firms have not materialized in any significant manner. Disaggregate level analysis, however, shows that some of the expected beneficial effects from foreign firms could be realised in some sectors.