Chapter – II

REVIEW OF LITERATURE

To formulate the problem precisely and to pin point a rationale of its undertaking, it seems highly logical to present a brief review of the studies done mostly in our country as it explores avenues for future and present research efforts related with subject matter. What follows, makes no pretence of being an exhaustive review of all the research work done on the problem, rather the objective is to indicate in a general way the type of work done in this direction and evaluates the research gaps in the existing literature. The review of various studies done in this chapter provides a broad spectrum about the productivity and efficiency levels in the Indian industrial sector in general and the manufacturing sector in particular which would be helpful in the formulation of appropriate methodology for the present study.

With the integration of the global economy, rapid pace of technological developments, media revolution, intensified competition and heightened customer expectations, manufacturing firms in India have started realising the significance of improving their productivity levels more than ever before. Various empirical studies have been conducted from time to time to examine the different aspects of Indian manufacturing sector. In this context, the present chapter reviews the literature relating to the present study which is presented below in a chronological order.

Banerjee (1975) examined the relationship between capital intensity and productivity in the context of Indian manufacturing industry. The analysis has been carried out for manufacturing sector as a whole and five individual industries (viz. cotton textiles, Jute textiles, sugar, paper and bicycle) by using CMI and ASI
data for the period 1946-64. The study highlighted that the performance of the manufacturing sector was sluggish over the period 1946-64. While labour productivity showed a significant upward trend during this period, but this sector did not indicate the presence of any ‘technical progress’. The hypothesis of constant returns to scale was not rejected. It has been found that elasticity of substitution between capital and labour is near unity in almost all the industries.

Qomen and Evenson (1977) attempted to measure scale economies, elasticity of substitution and total factor productivity growth using various forms of Cobb-Douglas and CES production functions (viz. CD (conventional), CD (scale version), CES (Kmenta approximation), SMAC relation, Scale modified SMAC relation) in the seven major agro-based industries with thirty-one sub-industries in India using ASI data. The data for three-digit level industries covered a period of three years. However, the four digit and five digit level industrial data covered only eight years, i.e. up to the year ending March 31, 1967. The estimates of elasticity of substitution between capital and labour were found to be low, that is below one. This result varied from industry to industry. The study concluded that the Indian manufacturing sector appeared to be relatively inefficient though the TFP measures did show some improvement over time. However, significant inter-industry differences in TFP have been noticed. The tobacco industry was the best performer with an exceptionally good score on the productivity front.

Rao (1977) used Factor Analysis to develop the composite index by finding out the ‘Principle Components’ of the groups consisting of various variables. In all she took 24 variables for 14 states to identify the backward states and for industrial disparities she took only 8 variables. She compared the disparities at three points of time, namely, 1956, 1961 and 1965. during the study period it was found that inter-state disparities in agricultural sector increased whereas in the industrial sector the variations decreased, through these continue to be very glaring. The
most developed industrial states were West Bengal, Maharashtra and Gujarat whereas Madhya Pradesh was least developed in 1956 while in 1961 and 1965, Rajasthan was at the bottom. It was also found that the relative positions of the various states did not change significantly over the study period. Similarly indices for other sectors were also developed and these indices were taken as raw data to arrive at ‘First Principle Component’ and then weighted indices were developed. It was found that overall disparities have decreased, though the decrease was not considerable. This study is pioneering in the sense that weighted indices were developed at the State level compared to unweighted indices.

Mehta (1980) attempted to analyse productivity trends for 27 Indian industries by using adjusted CMI and ASI data for the period 1953-65. The results revealed that there was a considerable diversity in the experience of different industries regarding trends of labour and capital productivity. Labour productivity was found to have increased significantly in industries like vegetable oil, chemical, tanning, glass and glassware and insignificantly in matches, iron and steel and cement industries. However, capital productivity has not increased appreciably, rather the reverse was true in most industries. The TFP of Indian manufacturing sector was found to have declined. The study noticed that most industries exhibited the presence of constant returns to scale and diseconomies of scale had not set in. The study demonstrated that there were inter industry differences with respect to ease of capital-labour substitution which primarily explained the inter industry growth differentials. The elasticity of substitution was found to be significantly different from zero and one in many industries.

Subramaniyan (1982) utilised CMI and ASI data spanning over the period 1953 to 1969 to explore regional efficiency in Indian sugar industry using Cobb-Douglas production function. The study reported labour as a more important factor than capital in terms of ‘factor elasticity’, ‘marginal productivity’ and relative
contribution to output growth in India, Uttar Pradesh, Bihar and Maharashtra. However, in Tamil Nadu and Andhra Pradesh, capital had been found to be a more important factor than labour. Constant returns-to-scale was observed in the states of Tamil Nadu, Maharashtra and Andhra Pradesh, whereas decreasing returns-to-scale was observed for all India as well as for UP and Bihar. Further, the study found Maharashtra to be the most efficient state compared to all other states under evaluation.

**Goldar (1983)** examined productivity trends in Indian manufacturing sector and estimated Total Factor Productivity (TFP) by applying Solow index and Translog index using firstly 1951-65 data covering all Census of Indian manufacturing (CMI) industries except “general engineering and electrical engineering” industry for 1951-58 and Annual Survey of Industries (ASI) data for 1959-65 and secondly, during the period of 1959-78 based on ASI data. This analysis shows a rising trend in labour productivity and capital intensity and a falling trend in capital productivity during this period. Growth in TFP seems to have been rather sluggish and its contribution to output growth is quite small. The observed rise in labour productivity and fall in capital productivity may accordingly be attributed to increasing capital intensity. Substitution of labour by capital seems to be the main feature of industrial growth. The result of Cobb-Douglas function estimation favours the assumption of constant returns to scale implicit in the TFP indices which is in broad agreement with the results of TFP indices especially in terms of the direction of TFP growth. The study has pointed out that the general industrial situation was not conducive to productivity growth. Under-utilisation of capacity, shortage of fuels, power and transport facilities and deteriorating industrial relations had a significant depressing effect on productivity growth. Moreover, gestation lags in the basic and capital goods industries, which accounted for a dominant part of investment in post 1956 period, must have had a depressing effect on productivity growth. A pronounced rising trend in capital
intensity was found, which implied that the growth in industrial employment has seriously lagged behind the growth in industrial investment and output. To some extent this is a result of the changing industrial structure in favour of basic and capital goods industries. It has been observed that metals, chemicals, rubber, petroleum and machinery industries are among the lowest ranked in terms of TFP growth, since these are the industries in which import substitution has been attempted on a considerable scale. Though the policy of import substitution contributed much to the objective of self reliance, yet it has been inimical to productivity growth.

Rao (1983) examined the inter-state disparities for 16 states by taking 51 variables for eight sectors viz., agriculture, general industrial sector, small scale industrial sector, banking, power, transport, health and education. She employed the technique of Factor Analysis and subsequently Composite index of development was derived by using various sectoral indices for the years 1975-77. The study reveals that the state of Punjab, Haryana, Tamil Nadu, Uttar Pradesh, Kerala and Gujarat were the agriculturally developed states, whereas the state of Madhya Pradesh, Assam, Orissa, Karnataka, Jammu and Kashmir and West Bengal were the agriculturally backward states and Rajasthan, Andhra Pradesh, Bihar and Maharashtra were the average states. For the general industrial sector, the states of Maharashtra, Gujarat, Tamil Nadu, West Bengal, Haryana and Punjab emerged as the developed states. With regard to small scale industrial development, Punjab holds the first place followed by Haryana. The state of Maharashtra occupying first place with respect to general industrial development, occupies fifth place in case of small scale industrial sector. For the banking sector, the states recording high industrial values have also obtained high index value and so on. When composite index of development was prepared, the state of Punjab was the most developed state in India as it obtained the highest index value (29.00) followed by Maharashtra, Kerala, Tamil Nadu, Haryana, Gujarat, West
Bengal and Karnataka. For the sectoral level of development, inter-state disparities were the highest in case of small scale industrial sector. The coefficient of variation for all the sectors were high enough to indicate the wide interstate disparities.

Sharma (1986) measured the regional disparities in industrial development in India during the period 1960-61 to 1979-80. However, the detailed analysis has been carried on at three points of time, namely 1960-61, 1970-71 and 1979-80. Mainly tabular analysis has been used to analyse the level, growth and pattern of industrial disparities. Correlation and multiple regression techniques have also been used to examine the relation between variables. Thirteen indicators were selected to reflect the different facets of industrial disparities in the State of India. To derive the objective weights for different indicators for formulating a composite index, Factor Analysis was used and each indicator was assigned weights as per the factor loadings obtained. To examine the diversification of industries, coefficients of specialisation and localisation were worked out. Further, to examine the factors in regional disparities, fifteen variables representing different aspects having bearing on industrial development were considered and again Factor Analysis was applied to examine the contribution of different variables towards industrial disparities. Discriminant analysis was also applied to see the relative contribution of different factors in discriminating the two group of States. It was found that wide disparities existed amongst the States, though there was a tendency towards decline. The composite index of industrial development showed that the State of Maharashtra, West Bengal, Gujarat and Tamil Nadu occupied the top four positions during 1960-61, however, in 1979-80, the picture showed a slight change. During the study period, Punjab and Andhra Pradesh improved their positions. The analysis of the factors affecting industrial disparities amongst different states revealed that urbanisation, per capita income, vehicles, loans and energy were more important variables and explained more than 80 per
cent of the variations in the level of industrial development as measured by composite index of industrial development.

**Desai and Shah (1986)** studied the tendency of Indian industries over a period of time (1969 to 1980-81) with the help of Location Quotient, Coefficient of Localisation and Regional Concentration Index. The analysis has been carried out for sixteen major States industry groups at 2-digit level and other minor industry groups were clubbed together. The data base was Annual Survey of Industries, census sector for the year 1969-70 and 1980-81. It was found that the value of Regional Concentration Index were very low probably due to diversified inherent nature of industrial base. The structural changes in the concentration of industries over time were examined through rank-correlation coefficients giving ranks to the values of Regional Concentration Index in descending order for both the years. The rank correlation was 0.82 and was statistically significant at one per cent level which indicates that there has not been significant change in the level of concentration of Indian industries. To see the relationship between the level of concentration of industries and labour and capital productivity among these industry groups, the correlation coefficients between them were calculated which turned out to be statistically non-significant. This shows that the productivity ratios did not provide better explanation to industrial concentration.

**Ahluwalia (1991)** analysed the TFPG performance of Indian manufacturing sector at a detailed level of disaggregation (for 63 industry groups of manufacturing at one level and for used-based sectors, i.e. intermediate goods, consumer non-durables, consumer durables and capital goods, at another level) by using ASI data for the period 1959-60 to 1985-86. The analysis of translog index of TFPG clearly brought out the poor performance with respect to TFPG up to the end of the seventies. She found a structural break in the TFPG in early eighties, which she called a ‘turnaround’ in TFPG behaviour. An important feature of the
improvement in TFPG in the first half of the eighties was that it largely reflected improvements in labour productivity. Capital productivity showed neither an increase nor a decrease. The consumer goods sector was the leader in the turnaround in TFPG after 1979-80. The intermediate goods sector, which was worse performer in the seventies, showed a significant improvement later although its TFPG continued to be relatively low, i.e. 1.4 percent per annum. The capital goods sector showed a considerable improvement from 1.7 percent per annum to 3.4 percent per annum, but the improvement was not statistically significant. The production function analysis based on Translog production function using pooled cross-section and time-series data showed that there has been negligible and insignificant growth in TFP in the manufacturing sector over the period from 1959-60 to 1982-83 and there was a distinct upward shift after 1982-83. The estimates for the sector as a whole also suggested that the returns to scale are not constant and the technical progress had a capital saving bias. Among the used based sectors, the hierarchy of TFPG remained nearly the same as the two larger use-based sectors (i.e., intermediate goods and consumer non-durables) performed badly compared to the other two sectors. The upward shift in TFPG was established for all the sectors except capital goods. Technical progress was found to be Hicks-neutral in intermediate goods and capital saving in consumer non-durables and capital goods. In consumer durables, however, there was evidence of the emergence of a capital using bias in the eighties. Ahluwalia found that improvement in the infrastructure sectors and reorientation in the policy frame are the two significant factors behind the turnaround in the productivity growth in the eighties.

Goldar and Aggarwal (1992) examined the extent of technical efficiency in Indian engineering industry for the year 1987-88. For this they estimated three inputs frontier production function by corrected ordinary least squares method for top hundred engineering firms. Average technical efficiency was found to be 58.7
percent. The best five firms in terms of technical efficiency were found to be Maharashtra Scooters, Bajaj automobiles, Bharat Heavy electrical, Bharat Earth Movers and Indian Telephone industries. Around twenty five percent of firms were found to have fifty percent efficiency level. Major determinants of efficiency were found to be size of the firm, expenditure on research and development, import-intensity etc. Also, it was found that efficiency is lower in public sector firms compared to firms in the private sector.

Jha and Sahni (1993) examined the efficiency of Indian sugar industry using CMI and ASI data for the period 1960-61 to 1986-87. Using the translog cost function, the study observed a mild downward trend in the pattern of allocative inefficiency in the Indian sugar industry. The following were the major conclusions drawn by the study: i) Capital using and labour saving character of technical progress in the industry; ii) the elasticity of cost with respect to output confirmed the presence of diseconomies of scale in the industry; iii) the government’s decision to expand capacity in the industry is wrong; iv) complementary nature of labour and capital is observed throughout the study period; v) no major structural break has been observed in the pattern of production; and vi) a mild downward trend in the pattern of allocative inefficiency in the Indian sugar industry has been observed.

Neogi and Ghosh (1993) made an attempt to investigate the inter-temporal efficiency movements and inter-industry efficiency variations in Indian manufacturing sector. They utilised panel data culled out from Annual Survey of Industries over the period 1974-75 to 1987-88. Using two basic approaches for measuring technical efficiency it has been found that most of the industries are concentrated below 50 percent level of efficiency and there is an overall declining trend across industries with some exceptions where efficiency has been rising or has remained stagnant.
Gajanan (1995) measured the technical efficiency of the industrial groups affiliated under the 3-digit classification of Food and Tobacco, Cotton Textiles, and Non-metallic Metals, Machinery and Electrical Equipment industries. Using the stochastic production frontier approach, the findings revealed that average technical inefficiency measures increased for each industry during the year 1985 in comparison to the year 1976. Moreover, the analysis of relative measure of inefficiency reveals that each industry has become more inefficient over time.

Goldar (1995) estimated the TFP growth in organised manufacturing sector during the period 1970-71 to 1990-91. He used single deflated value added. According to these estimates TFP in Indian manufacturing grew at the rate of 1.55 percent per annum in the period 1970-71 to 1980-81, which rose to 3.85 percent per annum during 1980-81 to 1985-86 and further to 5.05 percent per annum during 1985-86 to 1990-91.

Ray (1997) used the non-parametric method of Data Envelopment Analysis to measure Malmquist productivity indices for manufacturing in the different states of India during 1969-84. The measured Malmquist index was used to decompose the contribution of technical change, change in technical efficiency, and change in scale efficiency. The analysis shows an overall average decline at the rate of 2.89 percent per annum. At the individual level, although most states experienced productivity decline, considerable regional variations were evident. A non-parametric decomposition revealed that regressive technical change accounts for most of decline in productivity. A multivariate regression analysis has been carried out with average annual productivity growth rate in a state as dependent variable and a number of socio-political and economic variables as regressors. The results of regression analysis showed that while an increase in degree of urbanisation and the capital labour ratio increased productivity growth, while a higher proportion of non-production employees to production employees hindered
the productivity increase. Worsening industrial relations scenario resulted in a higher number of man days lost per worker also deterred productivity growth. The study did not confirm to the popular notion that in the communist parties dominated states the productivity growth is generally slow ceteris peribus.

**Gangopadhyay and Wadhwa (1998)** analysed, at the disaggregated level of two-digit industrial classification, the changing pattern of labour productivity, labour costs and TFP in Indian industries over the period 1973-74 to 1993-94. They divided the entire study period into two sub periods, 1973-84 and 1984-94. It has been found that the increase in capital intensity was accompanied by gains in labour productivity. The rate of growth of labour productivity was consistently higher in the second sub-period in all industries. The study also explored that gains in labour productivity have been associated with falling unit labour costs over the period. In four major exports driven industries, namely, textiles, leather, metal products and other manufacturing, the rising labour productivity, capital deepening and falling labour costs were accompanied by a rise in the rate of growth of employment and wages. Total factor productivity growth (TFPG) estimated were obtained by two methods, the growth accounting approach and the production function approach. The analysis of estimates of TFPG obtained from Translog index showed that the front-runner in the TFPG performance is the export driven industries. The only industry in which TFP fell during the period 1974-93 was wood and wood products. The most of industries experienced a turnaround in the early 1980s in respect of TFPG but there seems to be a reversal in the later years. The results of panel estimation of the Translog production function with and without industry effects showed: (1) TFP grew at the rate negative two percent during the period 1973-74, and (2) technical change was not Hicks-neural, but capital augmenting. The author mentioned that their results are in contrast of the results of the Ahluwalia’s (1991) in following respect; (i) the present study confirmed a labour saving bias in technical change while the
Ahluwalia’s study found a capital-saving, bias (ii) Ahluwalia found a structural break in TFPG since 1982-83 while no such structural break in TFPG from 1980 to 1992 has been noticed.

**Neogi and Ghosh (1998)** assessed to see the impact of liberalisation on the performance of four-selected industry groups, namely, (1) chemical, (2) textile, (3) non-metallic mineral products and (4) electric machinery, by using firm level data for period 1989-94. The performance indicators chosen to study the impact of economic reforms on the firms were labour productivity, growth of value added, capital intensity and total factor productivity (TFP). The estimates of technical efficiencies of selected industrial groups were obtained by using frontier production model with the help of Corrected Ordinary Least Square (COLS) method. The results indicated that productivity growth and efficiency levels have not improved as per expectation during the post-reform period and the distribution of efficiency is skewed. The TFP growth has fallen very sharply during the period of reforms with the exception of chemical industry. The relationship between labour productivity and capital intensity indicated a general downfall of efficiency of the firms during the study period. The level of technical efficiency for all the industries was found to be very low and no significant improvement was observed in this level during the post reform period.

**Mitra (1999)** estimated the time-variant technical efficiency and TFPG by using panel data for 15 major states and 17 two-digit industry groups. He used ‘within’ estimation procedure for capturing TFPG and its components with the help of Cornwell et al. (1990) model. A value-added and a four input-output function for each of the 17 industry groups using both Cobb-Douglas and Translog specifications have been estimated. The study reported the results of only Cobb-Douglas value-added function because: (1) output function did not yield desirable results in terms of right-signs and significance of coefficients; (2) in case of
Translog specification, monotonicity and convexity properties were not satisfied. The TFPG in a large number of industries seems to have improved across most states during 1985-86 to 1992-93 as compared to the rates estimated for the period 1976-77 to 1984-85. Technology acquisition, efficient utilisation of resources and infrastructure development were considered some of the factors, which possibly contributed to increase in TFPG.

Kumar (2001) endeavoured to analyse regional variations in technical efficiency of Indian manufacturing sector using the method of SFA. The results revealed wide variations in the technical efficiency of manufacturing sectors of different states. The highest level of technical efficiency has been observed in the manufacturing sector of Maharashtra. The states of Maharashtra, Karnataka, Gujarat and Haryana operate close to maximum technically feasible production levels since their manufacturing sectors realised more than 90 percent of their technical potentials. In the remaining 11 states including the industrially developed states of West Bengal and Tamil Nadu, the level of technical efficiency has been observed to be less than 80 percent. It has been found that the mean technical efficiency for 15 states was 77 percent.

Unni et at. (2001) analysed the trends in growth and efficiency in the utilization of resources in the Indian manufacturing industry before and after the introduction of economic reforms. The study used a comparative analysis of the Indian figures with Gujarat, one of the most industrially developed states of the country for four period of time 1978-79, 1984-85, 1989-90 and 1994-95. The data has been taken from the Annual Survey of Industries (ASI) and National Accounts Statistics using the growth accounting technique for four data points. The results showed that the growth in manufacturing sector in Gujarat was more efficient than the average all-India growth after the reforms. The average TFPG in India was negative during this period. Gujarat’s strategy of physical infrastructure
development, leading to industrialisation has been the main reason for the growth of the state’s manufacturing sector.

**Parmeswarn (2002)** explored the impact of economic reforms on technical efficiency using firm level data from selected industries in India. Using the technique of SFA, the study revealed that all the industries considered have registered a higher rate of technical progress in the post reform period. The effect of change in the policy environment on technical efficiency was found to be varying among industries. The study also found that firms’ involved in the international trade through export and import of raw materials and technology had a positive effect on technical efficiency.

**Rajesh and Duraisamy (2002)** analyzed the effect of economic reforms on Indian unorganized sector in general and on the manufacturing sector of Indian states in particular. The study identified that one of the major problems confronting the India unorganized manufacturing sector is to increase the level of production through improvement in productivity, leaving the employment-generation capacity of the sector untouched. Further, in productivity growth and efficiency aspects, a wide gap is noticed across the Indian states. A subsequent regression shows that there is a tendency towards convergence in the productivity growth rate across the Indian states. It suggests that technological upgradation needs to be prioritized if the output of the unorganized sector has to be improved.

**Ray (2002)** examined whether India’s Economic Reforms have Improved efficiency and productivity, using Non-Parametric Analysis for the period 1986-87 to 1995-96. The study considered 22 Indian states to estimate efficiency and productivity trends. After dividing the data into two sub periods i.e. pre-reform period up to 1991 and post-reform period after 1991, the study found that the states with higher capital-labour ratio and higher percentage of the urban population experienced a greater acceleration in the productivity growth rate after
the reforms. At the same time there was a tendency towards convergence in the
sense that a higher pre-reform growth rate led to less scope for further
improvement. The study also revealed that on the average the annual rate of
productivity growth has been higher in the post-reform period than in pre-reform
period. However, some states have actually experienced a slowdown in the
productivity growth or even productivity decline after the reforms.

**Goldar and Kumari (2003)** examined the impact of import liberalisation
on productivity growth of Indian manufacturing industry in the 1980s and 1990s.
The estimates obtained indicated that during the 1990s, a decade of major
industrial and trade reforms, there was a deceleration in TFP growth in
manufacturing, corroborating the findings of several earlier studies. However, a
closer examination revealed: i) Capacity utilisation was a significant factor
influencing productivity growth in manufacturing industries; ii) there was an
increase in capacity utilisation in manufacturing sector in the 1980s and a fall in
the 1990s. Multiple regression analysis was carried out to study the factors
influencing TFP growth in manufacturing industries. The results showed a
significant favourable effect of tariff reforms on industrial productivity. The
results also indicated that slower growth of agriculture in the 1990s and gestation
lags in investment project may have had an adverse effect on TFP growth of
Indian manufacturing industry in this period.

**Chattopadhyay (2004)** examined the trends in TFP of manufacturing
sector in West Bengal. The paper examined the overall industrial scenario of West
Bengal for the past three decades. The paper studied the productivity of capital and
labour for the two digit industry groups and the TFP of manufacturing sector of
West Bengal as a whole *vis-à-vis* all India, and for some other selected groups of
industries for West Bengal using ASI data. The study revealed that the state of
West Bengal lost its earlier status of one of the highly industrialised state of the
country. Its share to all India net value added, share of employment and factories has come down drastically. Profitability of total manufacturing sector has gone down. Productivity of the capital of the manufacturing sector has declined, while labour productivity has increased. However, the latter has increased mainly due to a few industry groups, which are highly capital intensive and have contributed around 85 per cent of the profit of total manufacturing sector. The total factor productivity (TFP) of West Bengal’s manufacturing sector as a whole has been declining, while it has been increasing in case of India. The TFP of six industry groups, which played a dominant role during the early 1960s, has gone down except jute industry, which itself is a dying industry. That means no new industry groups have come up to take up the position of these industries, which have been performing badly and the industrial slowdown has not been arrested yet in the state.

Jain (2004) analysed the growth of small scale sector, government policy towards small scale sector along with problems faced by them due to globalisation in the pre- and post-liberalisation periods. Since small scale industry constitutes a very important segment of Indian economy and has emerged as a dynamic and vibrant sector of the economy, therefore, new policy initiatives since 1991 by the government caused a shift in focus from protection to promotion. Before the introduction of economic reforms the small scale sector was overprotected and with globalisation this sector is now exposed to severe competition both from domestic and foreign firms. In the post-reform period the government took a number of steps including partial de-reservation, change in investment limits, and facilities for foreign participation, establishment of growth centers, marketing assistance and incentives for quality improvements. The study reveals that the problems of small scale sector are multi-dimensional especially in the liberalised environment which would further be intensified with the arrival of multinational companies and removal of quota restrictions in the textile sector. In this context,
the study suggests that the government should give priority to the timely and adequate loans to the small scale industries along with time-bound promotional concessions, upgradation of technology, marketing assistance through vigorous research and development efforts.

Nikaido (2004) attempted to present some policy implications for the better development of small scale industrial sector which after the liberalisation of Indian economy in 1991, was recognised as a growth engine of the economy. The technical efficiency of this sector was measured by using a stochastic production frontier model. The impact of firm size and geographical agglomeration on the measured technical efficiency was also examined in the study. The industry state wise data for this study were drawn from the second all India census of small scale units, published by development commissioner (SSI) in 1992. Variables such as production, employment, fixed investment, capacity utilisation and the number of units were utilised. It was observed that due to competition with large industries and foreign firms, small scale industry has not had the incentive to grow into larger units and has therefore ignored the quality of its goods. Moreover, agglomeration of firms was found to be positively affecting the measure of technical efficiency, while the firm size had a negative effect on it. Thus, the supporting policy itself might have prevented the potential capacity and innovative nature of small scale industrial sector. It was suggested that for the promotion of clusters, the government needs to support infrastructure around clusters and technological upgrading. Moreover, promotion of links with external agents like buyers and export traders can provide management know how, improved designs and new techniques for the better development of small scale industrial units.

Latha (2005) highlighted that small scale sector has acquired a prominent place in the socio-economic development of the country during the last five decades. It has been assigned an important place commensurate with its potential
for employment generation, dispersal of industry in rural areas and export promotion. In this context, small scale sector can be termed as a nursery of economic development. To overcome the problems of small scale sector, government must provide additional facilities, schemes, incentives and encourage innovative activities of entrepreneurs for the development of small scale sector in the era of globalisation and competition.

**Mahambare and Balasubramanyam (2005)** analysed the impact of trade liberalisation on Indian manufacturing sector. The study evaluated the firm level technical efficiency in India since 1991 reforms by estimating Cobb-Douglas production function for thirteen manufacturing sectors. The study revealed the mixed impact of 1991 reforms on the selected manufacturing sector. Average technical efficiency of firms increased in eight out of thirteen sectors studied. Improved access to imported technology in the post-reform period seems to have had a positive impact on the efficiency. Although foreign owned firms continue to be the most-efficient, yet their advantage in technical efficiency seems to have declined in the late 1990s. Technology acquisition, efficient utilisation of resources and infrastructure development were considered some of the factors which possibly contributed to the increase in total factor productivity growth.

**Bhanu (2006)** also made an attempt to examine the CU pattern in 16 two-digit and 33 three-digit industries during the period 1980-2000 and postulates that CU in Indian industries has been higher during the post-reform period than at any other time. Further, CU in Indian industries is estimated at the aggregated level, for the pre- and post-reform period, using theoretically pertinent three different methodologies. The results clearly show that temporal pattern of rates of utilization are the same; whatever method of CU is applied.

**Kambhampati (2006)**, analysed the impact of financial liberalisation, corporate governance on the efficiency of firms in Indian manufacturing using the
technique of SFA. The study found that the government and Indian financial institutions have a similar impact on the firm efficiency. It has also been confirmed that the difference between the pre-reforms and post-reforms impact of different sources of funds on the technical efficiency is insignificant.

Kumar (2006) attempts to estimate the trends in growth of total factor productivity of Indian chemical industries at the sub sectoral level. The study covered the period of 22 years from 1980-81 to 2001-02. The entire period is divided into two phases as pre-reform period (1980-81 to 1990-91) and post-reform period (1991-92 to 2001-02). The total factor productivity growth (TFPG) is estimated using Translog model with three inputs, viz. labour (L), capital (K) and the intermediate inputs (R) raw material consumed. The factor productivity growth rates were computed for the five major sub sectors of Indian chemical industries. The results showed that the impact of economic reforms on the productivity levels of an industry at the aggregate and sub-sectors level do vary significantly. While the net impart of the reforms process on total factor productivity growth was found to be poor at the aggregate level. The sector: drugs and pharmaceutical, paints and vanishes, basic chemical and dyes and dyes stuff industries greatly benefited from the liberalization process. Within the sub sectors, the worst affected was the fertilizer industry as the TFPG declined significantly in the post-reform period. Results further showed that the productivity differentials were found at firm level as well as in chemicals industry.

Mishra (2006) in his study highlighted the working of small scale industries in Orissa during the year 1996-97 the 1998-99 and in the year 2003-04. The period witnessed policy changes at different level, which might have affected the working of manufacturing sector in general and manufacturing small scale industrial units in particular. The study is based on two benchmark studies conducted on the performance of the small scale industrial manufacturing units in
five small industrial clusters in Orissa. The performance of small scale industrial units has been assessed by fitting the Cobb-Douglas production function for four financial years. Most of the units taken were raw material intensive and a few labour intensive depending upon the type of product categories. It was observed that no significant growth took place in the factor productivity in any of the product categories over the two periods of time. The incidence of closure of these units in Orissa was found to be very high. The main reasons for the sickness and closure of small scale industries in the state were lack of demand, tax problem, competition in local markets, financial problems and attitude of the entrepreneurs. A bottom up approach is need of the hour—such approach will bring an attitudinal change among the entrepreneurs in the state and will also help in the identification, assessment and promotion of small scale units. These small scale units will use the local resources and will have strong linkages with the local and outside markets. In such a way the small units will be sustainable and would help in a positive way in their further development, in a state like Orissa.

Singh and Aggarwal (2006) evaluated the trends in total factor productivity growth, technical change and efficiency change in the sugar industry of UP using the primary data set of 36 sugar firms of UP collected over the period 1996/97 to 2002/03. The empirics describe that the TFP in sugar industry grew at a moderate rate of 1.6 percent per annum during the entire study period. The decomposition of TFP into its two mutually exclusive events i.e., technical change and efficiency change disclose the fact that technical change dominate the efficiency change in the sugar industry of UP. Thus, catching up is relatively scant factor responsible to TFP growth compared with technological progress. Further, the results substantiate that the magnitude of average TFP growth varies significantly across ownership, size and location of sugar mills. Sector-wise estimation of the TFP reveals that the private sector has witnessed the highest growth in TFP, followed by the co-operative sector. Regional pattern of the TFP
growth shows that the western region of UP achieves relatively better TFP growth than the eastern and central regions. Post DEA analysis confirms the hypothesis that TFP growth is positively associated with the plant size. It has been concluded that large-scale production in the industry may be encouraged to take advantage of the economies of scale. This would lead to greater efficiency in industry, and consequently force the production points closer to the frontier. Economies of scale in the industry coupled with latest technology acquisition would further develop downstream activities in the sugar related industries.

Kumar and Arora (2007) endeavoured to observe technical and scale efficiency in Indian manufacturing sector using a cross-sectional analysis of 127 manufacturing industrial groups classified at 4-digit level for the year 2003-04. Using the technique of Data Envelope Analysis (DEA), the study concluded that the average Overall Technical Inefficiency (OTIE) is to the tune of 39.7 percent in Indian manufacturing. Only, nine industrial groups are identified to be globally efficient along with 17 locally efficient industrial groups. However, the observed OTIE is dominated by improper management practices i.e., pure technical inefficiency, whereas scale inefficiency is relatively a scant source of OTIE. Further, decreasing returns-to-scale was found to be prevailing in Indian manufacturing sector and the environmental variables such as capital deepening, profitability and labour skill are positively affecting technical efficiency.

Sidhu (2007) conducted a study at aggregated and disaggregated levels for manufacturing sector for the period 1973-74 to 2002-03. The study was based on the statistics of Annual Survey of Industries (ASI) using growth accounting method to measure total factor productivity. Results at the aggregated level revealed that growth in productivity was discouraging during 1973-83 period; there was some increase in the growth during 1983-93 and slump during the 1993-2003 period. However, at disaggregated level, the performance of the industry has
varied widely within as well as across the states. There was a sharp decline in the growth of industrially developed state of Maharashtra after the reforms period while the state of Haryana showed improvements. Also, the state of Orissa, which was industrially backward, showed improvement in the reforms period.

Ray and Pal (2008) endeavored to analyze trends of Capacity Utilization in Indian Chemical industry. Applying, minimum capital output ratio method along with the estimation of Translog cost frontier, the study reported a declining trend of CU over the period of 1979/80 to 2003/04. However, the decline became more noticeable after mid 1990’s due to slow increase in actual output. The observed slow increase in actual output is due to stagnated demand and rapid expansion of capacity output as a result of abolition of licensing rule consequent to economic reforms.

Sahoo (2008) decomposed total factor productivity into technological change and efficiency change with the help of non-parametric approach on the basis of data obtained from ASI and National Accounts Statistics. The study covers the period from 1978-79 to 1992-93, which was further subdivided into two halves: the first sub-period 1978-79 to 1985-86 (pre-liberalisation period) and the second sub-period 1985-86 to 1992-93 (transition period). The study examined the performance of 28 sunrise Indian industries and also made an attempt to show that, contrary to the impression given by Fare et al. (1994) under the assumption of constant returns to scale, the two Malmquist indices are equal in the case of technology structure involving one input one output and multi input and output technology. The findings suggested that either of the two Malmquist indices and any one of the two ratio components of technical change can be taken as the measure of productivity growth and technical change respectively. Further, the study concluded that Indian sunrise industries experienced productivity decay from pre-liberalisation period to transition period of economic liberalisation.
though industries exhibited higher technical progress in the transition period, yet this could not contribute to higher productivity growth. It is precisely due to the fact that there has been growing inefficiency in most of the industries in this period and growing inefficiency was due to the institutional and economic environment that did not completely favour the management of new technology. The study suggested that government should take important and bold policy decisions to bring about change in institutional and environmental set up which must be properly linked with economic liberalisation to make productivity growth a sustainable phenomenon.

**Kumar and Arora (2009)** decomposed the output growth in Indian manufacturing sector into inspiration component (i.e., total factor productivity growth) and perspiration component (i.e., inputs growth) using growth accounting framework. Using the Malmquist Productivity Index (MPI), TFP scores have been calculated for the period 1980-81 to 2001-2002 using the Annual Survey of Industries (ASI) dataset of 16 major industrial states. The study observed that: i) in the manufacturing sector of 10 states, the output growth has been observed to be primarily driven by TFP growth and thus, inputs growth has emerged as a scant source of it; ii) the economic reforms process since 1991 failed to mark a significant dent on the growth of manufacturing sector of selected Indian states. This is supported by the fact that in 14 states, the rate of output growth has been found to be low during the post-reform period in comparison to what has been observed during the pre-reform period; and iii) the analysis of \( \sigma \)- and \( \beta \)-convergence rules out the presence of the phenomenon of convergence in the manufacturing sector of Indian states.

**Suresh and Shashidhar (2009)** have conducted a study which highlights the importance of small industries and their role in the economy and the impact of economic reforms on the growth performance of small scale industrial sector. It
has been observed that a significant contribution was made by this sector in employment generation as well as rural industrialisation. It has also been noted that under the changing economic scenario, the small scale sector has the opportunities to explore as well as challenges to face. The opportunities can be explored through cost effectiveness, improving quality of the product and diversifying the production process. However, the challenges can be confronted by enhancing competitiveness at both intra- and international levels. The intra-national competition has come from the large industrial sector whereas, the international competition is to be faced from the large multinational corporations.

Arora (2010) examined capacity utilization, technical efficiency and total factor productivity growth in Indian sugar industry using the data for 31 years spanning over the period 1974-75 to 2004-05. Using the linear programming based data envelopment analysis, the study concluded underutilisation of capacity to the tune of 13 percent per annum. Alongside, there exists high technical inefficiency to the tune of 35.55 percent per annum. The major cause observed for such amount of technical inefficiency is managerial technical inefficiency. The analysis of TFP growth reflects that the technical progress is major source of output growth in Indian sugar industry during the post-reforms period. The analysis of impact of economic reforms delineates a precipitous decline in capacity utilization and technical efficiency during the post-reform period in comparison to the pre-reform period.

It may be observed from the above reviewed studies that most of the work has been done relating to the overall Indian manufacturing sector and comparatively scant attention has been paid to evaluate the production structure, efficiency and levels of technical progress in Indian manufacturing sector during
reformed period. The present study is, therefore, an attempt in this direction and incorporates the major considerations relating to the measurement of growth performance of Indian manufacturing sector, production structure and factor substitution in Indian manufacturing sector, examine the trends in industrial concentration among different states, technical change and efficiency change in Indian manufacturing sector before and after economic reforms. Further, the analysis of productivity performance of Indian manufacturing sector to check its growth robustness in the competitive environment may have an important bearing on Indian industrial sector in general and manufacturing sector in particular during reformed era.