STRUCTURAL CHANGES IN LABOUR AND LABOUR PRODUCTIVITY IN THE ORGANISED MANUFACTURING SECTOR OF PUNJAB

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DEDICATED TO MY

PARENTS

AND

SUPERVISOR

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FOR SPENDING

THEIR PRESENT

TO MAKE

MY FUTURE

CERTIFICATE

I hereby certify that the work which is being presented in this thesis entitled "Structural Changes in Labour and Labour Productivity in the Organized Manufacturing Sector of Punjab" in partial fulfillment of the requirements for award of the Degree of Masters of Philosophy in Economics, submitted in School of Management and Social Sciences, Thapar University, Patiala, is an authentic record of my own work carried out under the supervision of Dr (Ms) Ravi Kiran, Associate Professor, School of Management and Social Sciences.

The matter presented in this thesis has not been submitted for the award of any other degree of this or any other University.

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ABSTRACT

Liberalization, privatization and globalization are the buzzwords today. The government of India introduced major reforms in July 1991. After the advent of LPG, the manufacturing sector in Punjab is in the throes of a very significant phase of transition with severe challenges and many new opportunities. To compete in this globalized world, productivity of manufacturing sector is a crucial factor. The significance of productivity in increasing national welfare is now universally recognized. In every country, industry or organization, the main source of economic growth is a result of an increase in productivity. Nowadays, it is widely accepted that productivity is a key performance benchmark for firms involved in the manufacturing sector. This is because improvement in productivity is related to increased profitability, lower costs and sustainable competitiveness. Productivity is defined as the efficient use of resources in the production of various goods and services. Rising productivity implies that either higher output is produced with the same amount of input, or that less input are required to produce the same level of output. The present comprehensive, in-depth study analyses the performance of Punjab manufacturing sector in terms of productivity.

The present study analyses the trends in productivity for the Punjab manufacturing for the period 1980-81 to 2004-05. To examine the impact of LPG on the manufacturing sector of Punjab, the entire period is dividing into two sub-periods. Period I is 1980-81 to 1991-92, which is pre-reform period, and period II is 1992-93 to 2004-05, which is the post-reform period.

The study analyses the trends in output (value added), inputs (labour, capital), labour productivity, capital productivity and capital intensity for Punjab manufacturing sector at aggregate and disaggregate level and at two-digit level for the entire period 1980-81 to 2004-05 as well as for sub-periods, period-I and period-II.

An attempt has been made to trace the factors influencing labour productivity for Punjab Manufacturing. Ordinary least square and step wise regression techniques have been used for analyzing the factors affecting productivity.

A detailed analysis for pre-reform period and post-reform period shows that in terms of performance of labour productivity and capital productivity, three industries, namely manufacture textile # 17, manufacture of furniture # 36 and wood and products of wood and cork, except furniture; articles of straw and plating materials # 20 record a higher growth rate. The lower performance is recorded by coke, refined petroleum products and nuclear fuel # 23. This is followed by manufacture of office, accounting and computing machinery # 30 and tanning and dressing of leather, luggage, handbags saddlery, harness and footwear # 19.

The regression results show that coefficients for output growth variable are positive and statistically significant in most of the industries in Punjab. A positive and significant relationship has also been observed between capital intensity and labour productivity.

CHAPTER-I

INTRODUCTION

Globalization and closer integration of economies have had significant impact on the economies of both developed and developing countries. It is in this context that many scholars have tried to study the impact of globalization on growth and employment, poverty and inequality. An important consequence of this is that it has brought into focus the central issue of growth and development, namely to what extent is the process of industrial revolution and diversification of labour force in developing countries like India and China accelerated or hampered by the new wave of liberalization of trade and increased FDI?

According to Pt. Nehru:

'Real process must ultimately
depend on industrialization'

It is well known that reforms have brought about far reaching changes in various sectors of Indian economy. Industrial sector occupies an important position in India. Changes occurring in this sector need to be carefully analyzed and the results need to be followed in order to optimize its contribution to Indian economy.

This study attempts to deal with the structural changes and growth of labour force in the organized labour market in Punjab in the pre and post globalization period. Globalization means gradual integration of economies through free movement of goods, services and capital. The first era of globalization during the nineteenth century was the rapid growth of international trade between the European imperial powers, the European colonies, and the United States. The process of globalization accelerated after World War II, subsequent to the formation of Bretton Woods's Institutions and the regeneration of Western Europe through the Marshall Plan. Globalization has proceeded with great speed since the beginning of the

1980s and most of the countries of the world have been more closely integrated with one another since then.

Significant changes have been witnessed in the Indian labour market over the recent years. These changes are intrinsically related to the opening up of the Indian economy. Accompanied with the changes, there has been an increasing concern regarding jobless growth, widening of inequality in terms of region, gender, and a mismatch between demand of skilled labour and its availability, especially in the emerging sectors. Main highlights of the report are:

- The compound annual growth rate (CAGR) of labour force, during 1999-00 – 2005-06, is notably higher for rural persons, than for urban persons, across all the categories of employment.
- The employment and unemployment growth rates are higher for the rural areas, than for the urban areas.
- The rate of unemployment is typically much higher among the persons with higher level of education, than among those with lower levels of education. Furthermore, the unemployment growth rates are much higher for the females, than for the males.
- The proportion of regular employed is relatively low compared to the self employed and casual employed.
- More females are in the casual labour market and in the self-employed category than males. Furthermore, rural females register high work participation rate than the urban areas.
- There is no significant change for percentage of male participation in regular employment whereas female participation is on rise.

India, due to the agrarian sector with seasonal operations, time disposition and availability for work has been the criteria for measuring employment. The accepted method of measuring employment is the usual status. Reliable estimates of employment/unemployment are generated through National Sample Surveys conducted once in five years by National Sample Survey Organization (NSSO). The concept recognizes time utilization only. Quality of work or income does not get reflected in the approach.

As per the results of the National Sample Survey conducted in 1999-2000, total work force as on 1.1.2000, as per Usual Status approach (considering both principal and subsidiary activities) was of the order of 406 million. About 7 % of the total work force is employed in the formal or organized sector (all public sector establishments and all non-agricultural establishments in private sector with 10 or more workers) while remaining 93% work in the informal or unorganized sector. The size of the Organized Sector employment is estimated through the Employment Market Information Programme of DGE&T, Ministry of Labour. The capacity of the organized sector to absorb additional labour force, taking into account the current accent on modernization and automation, is limited. In other words, an overwhelming proportion of the increase in the labour force will have to be adjusted in the unorganized sector. About 369 million workers are placed today in unorganized or informal sector in India; agriculture workers account for the majority of this work force. The Indian industry has been undergoing a structural change over the past few decades. Primary raw-material based industries dominated the industrial structure initially; the emergence and faster growth of metal based industries dominated in the second phase.

In the third phase of structural change, processed intermediates and inputs have emerged as important and dynamic segments of the Indian industrial structure. Various researchers have looked into different aspects of industrial sector from time to time. Employment in organized sector industries is such an area that has attracted many researchers to study and bring out important facts related to it. The present study is such an effort on our part.

Productivity is the sine-qua-non of modern state and occupies an important place in the development and growth of the nation. In analyzing the sources of economic growth in advanced countries economists have reached a conclusion that it is technical progress rather than capital accumulation or labour which contributes the most to the growth in output. The understanding of the process of growth in developing economies is still quite hazy and is subject to conjecture.

Kuznets (1966) pointed out that rapid growth in industrial productivity was an essential element in the development and structural transformation of the newly developed economies. Lindbeck (1984, 1986) drew attention to the poor record of developing countries in 'speeding up the rate of productivity growth.' While output in manufacturing in developing market economies increased by 5 per cent per annum during 1960 to 1981, the accompanying increase in labour input was as high as 3.7 per cent, this implies that the increase in labour productivity was about 1.3 per cent.

1.1 The Concept of Productivity

Productivity has become the buzz word of our times. The term productivity has been used in such a variety of senses, that it is exceedingly difficult to find out whether the term 'productivity' is synonymous with 'efficiency' or 'overall effectiveness' of a productive unit, be it a plant, a firm or a company. Productivity is elusive concepts that dose not lend itself either to a clear-cut definition or easy computation. Productivity is a subject surrounded by considerable confusion and people employ the same term but mean different things. Productivity is a word which we use broadly to express the overall efficiency relating to performance of industries. Smith, A. (1976) referred to efficiency and specialization, what in current nomenclature amounts to the concept of productivity. Although, there is no consensus on the definition of productivity yet everyone accepts it to be a measure of performance. No amount of economic juggling can alter the fact that in the long run, our solvency depends on the efficiency of our industries.

1.2 Partial Productivity

Productivity, when defined with respect to any one input ignoring other factors in the output-input ratio is termed as partial productivity. Partial productivity reflects the relative efficiency of the factor used; the effect of factor substitution as well as of changing productive efficiency.

1.3 Labour Productivity

Although a number of variables combine to affect changes in productivity, yet it is necessary that a particular yardstick of input factor be chosen that manifests in all type of production. It is generally believed that number of workers or man-hours worked should be used as an input factor. When output is divided by number of workers or man-hours the result is termed as labour productivity.

Several points are made in defence of the choice of labour man hours or in defence of the number of workers employed in calculation of productivity. Labour force in any country is one of the most important resources. Adequate supply of skilled and efficient labour is a great asset. Another, but in no way less convincing argument in favour of this measure, is that labour time is more readily measurable than other input factors and that it possesses a universal element common to all plants, processes and industries. This universality provides a common basis for measuring and comparing the relative productivity, not only in different units but also of different sectors of a country.

This definition, despite its simplicity and widespread usage, has not removed confusion either from analysis of interpretation and the reasons for it are manifold. It is difficult to dislodge the deep rooted notion from the mind of common man, inexperienced in the technique and methodology of productivity of analysis that labour productivity data measure the productivity of labour and not the productivity of all the combined input factors. Indeed, it would be difficult to visualize a situation in which a country can achieve higher standard of labour productivity despite its comparatively low standard of labour efficiency. According to Seigal (1961) labour productivity indices do not reveal changes in the intrinsic efficiency of labour, but rather the changing effectiveness with which labour is utilized in conjunction with other factors. As such labour productivity is not a measure of specific contribution of labour or of any one factor of production: it reflects the cumulative influence of operation of a large number of interrelated influences such as technological improvements, the rate of operation, the degree of efficiency achieved in different processes, the availability of supply and the flow of materials and components, as well as employer- employee relations, the skill and effort of workers as well as the efficiency of management.

It is often maintained that the element of labour input is quite obvious in the creation of capital to a great extent when it is assumed that capital plays a great role in determination of labour productivity. It is conceivable that the quality of capital employed is of overriding significance in explaining the magnitude of differential in productivity. Nevertheless, it is assumed that the quality of machine unquestionably reflects the role of labour in the creation of machines. Thus, it is considered appropriate to use labour input as the denominator.

1.4 Scope of the Study

In this study, aggregate, two digit manufacturing industries as covered under Annual Survey of Industries has been taken for the period 1980-1992 and 1993-2005 with a new study. The study has been undertaken at the disaggregative level at the two digit industry.

1.5 Data Source

The basic data source for the present work is 'Annual Survey of Industries'. This survey is being conducted every year since 1959 by National Sample Survey Organization and processed by Central Statistical Organization. Annual Survey of Industries relates to the registered sector of manufacturing. The National Industrial coding (NIC) 1998 has been used in the study.

1.6 Research Methodology

The main objective of the present study is to analyse productivity trends in Punjab manufacturing industries for the period 1980-1992 and 1993-2005. Productivity at the aggregate level gives an overall picture. With the view to study inter industrial pattern of productivity growth, analysis is done at two digit level of disaggregation. For time series analysis secondary data have been obtained from various data bases relating to Punjab manufacturing. Detailed data about registered manufacturing units have been compiled from Annual Survey of Industries (ASI). The gross measure of value added is obtained from net

value added and depreciation data as given in ASI. Value added is deflated by industry specific deflators. Labour input is represented by total number of persons employed.

1.7 Chapterisation

The study of productivity is an important aspect of the analysis of development. Productivity study has particular significance in the formulation of policies at the state as well as at national level. Chapter-I covers the meaning of globalization and importance of productivity of industries. The outlines of the study along with its broad objectives, data source and brief methodology have also been covered in the chapter I.

Modern economists have emphasized that technological progress is a major determinant of economic growth. In the following chapter II, we discuss the review of literature on the different economy. The review helps to know emphasis and direction of research being done, the time periods of the studies, the scope and limitations of studies conducted, the methodology adopted for measuring productivity indices, the conclusions drawn from these studies the objectives fulfilled and the benefits accrued. An attempt has also been made to find out the observations based on the review. This chapter presents the objectives of the study.

In the subsequent chapter III, model and methodology has been discussed. This chapter discusses the data sources of the present study.

Chapter IV focuses on the trends in labour productivity at the aggregate and disaggregates level and it also covers the factors affecting labour productivity.

Finally, chapter V covers the conclusion of the study, major findings, policy implications, significance, limitations and future scope of the study.

CHAPTER-II

REVIEW OF LITERATURE

2.1 Introduction

Many exploratory and interesting studies have been undertaken in India as well as in the other countries of the world in the field of labour factor. A quick review of earlier work is essential to place the present study in proper perspective. Some salient features and broad findings of individual studies on labour have been highlighted. The earlier studies are of two broad types:

-Studies on the organized manufacturing sector.

-Studies on the unorganized manufacturing sector.

2.1.1 Studies on the Organized Manufacturing Sector

Study by Beri (1962) estimates partial and total productivity indices for cement, cotton textiles, iron and steel and sugar for the period 1948 to 1955. Labour productivity has been taken as a ratio of value added and man hours. Man-hours used in labour productivity index are those worked by workers directly employed in factories. In total productivity fuel and power the material inputs and labour and capital inputs have been considered. The study concluded that cement industry and iron and steel industry showed an upward trend in productivity although it was not possible for it to meet the entire home demand. The cotton textile industry did not show a happy state of affairs. Plant and machinery in this industry needed immediate replacement. Labour productivity, in general, showed a positive rate of growth in most of the industries.

Among the four industries, cement industry registered the highest increase of total productivity (18.81 per cent per annum) as well as labour productivity (125.62 per cent per annum). The capital productivity declined during the period. Increased capital and increased

power consumption must have been the most important factors in raising labour productivity. In the computation of labour productivity man-hours worked by workers directly employed in industries are included. Man hours worked through contraction are not included. The study takes aggregate of 27 census of Indian Manufactures Industries (CMI) out of 29 and comparable Annual Survey of Industries (ASI).

Chatterjee (1973) studied only labour productivity for the period 1946-58 and 1960-65. The study covers twenty six manufacturing industries for the first period and twenty five industries for the period 1960-65. The first period uses CMI data and the second period is based on ASI data. The author observed a rising trend in labour productivity in all the 26 industries except in rice milling industry in the first period. While comparing the two periods, the study found the rate of increase in productivity to be much higher in the former period than in the latter. The sharp upward trend in productivity may be due to the abnormal conditions in base year (1946). The study is based only on labour productivity and data for the period 1946-58 is CMIE data and for the period 1960-65 the data source is ASI.

Mehta (1980) in a comprehensive study has calculated partial and total factor productivity indices for 27 large scale industries. The study also analyses inter industry correlation and parameters of Cobb Douglas and CES production functions. The inter industry correlation study throws light on the pattern of behaviour of economic variables. The Cobb-Douglas production function gives estimates of the marginal product of labour and capital, and sources of output growth and returns to scale. Through CES production function the elasticity of substitution and scale parameters are obtained. Each of these methods explains some components of technological change. The study covers the period 1953-65. An attempt has been made to prepare comparable data from CMI and ASI sources.

The study uses data on fixed capital, working capital, total productive capital, number of persons employed, wages, salaries and money value of benefits, output, depreciation and value added. Fixed capital is deflated by WPI of machinery and transport (1961-62=100). Working capital is deflated by wholesale price index of commodities. Total productive capital consists of fixed and working capital both added to arrive at total productive capital in

real terms. Value added and output figures have been deflated by relevant commodity prices from index of whole sale prices.

The overall results demonstrate that growth in output of industries like electric fans, electric lamps, iron and steel, chemicals, paper and paper board and confectionary has been quite high and sustained, whereas industries like cotton textiles, jute textiles and cement have had quite a low output growth. Labour productivity has increased significantly in industries like vegetable oil, chemicals, tanning, glass and glassware and insignificantly in matches, iron and steel, and cement. However, capital intensity had not increased significantly in most industries; rather the reverse is true in general.

This study of the Indian manufacturing shows that overall efficiency of the industrial sector declined during the period under study. The detailed analysis shows that the performance of some industries with diversified product ranges like bicycles, glass and glassware and electric fans has been fairly satisfactory, where as in the traditional industries like cotton textiles, jute-textiles, matches and sugar the overall efficiency has declined. Studies on returns on scale show the existence of economies of scale in many industries up to late fifties. In sugar, chemical, cotton textile and iron and steel industries, increase in capital per person is quite significant where as it declined in confectionery, fruit and vegetable processing, electric fans and electric lamps. In paints and varnishes, plywood, bicycles and sewing machines, it remained almost constant. In some industries, despite a rise in capital per person, it has not led to gains in labour productivity. Thus capital deepening in Indian industries is unwarranted and in many industries questionable. The analysis of Indian data has shown that labour productivity and capital cost increased significantly in consumer goods industries like vegetable oil, rice-milling and woolen textiles. In these industries capital has been substituted for labour. The elasticity of substitution is found to be significantly different from zero and one in many industries. In most cases it is low, which means that a higher quantity of capital (labour) has to be substituted for labour (capital) for same level of output.

To sum up the study shows that the rate of technological change in the growth process of Indian industries is not very significant. The only components of technological change in the

growth process that seem to have affected the growth process are capital intensity and factor substitution. Infact, output changes have been accompanied by parallel changes in employment implying that the major source of output growth is labour input. The traditional industries showed an overall declined trend in efficiency. One fact that clearly emerges is that in overall sense, technological progress, unlike in developed countries, has not been a contributory factor in Indian industrial growth.

For macro-trends the study examines productivity trends of census sector from 1959 to 1970. Labour productivity had an increasing trend, while capital productivity had a decreasing trend along with rising capital output ratio and capital labour ratio increased at a fairly fast rate. The index of total input increased five times (100 to 491) but the index of output increased to only 370. Total productivity index registered a decline. Solow's measure of TFP also showed a continued declining trend (-1.6). The result is that whatever growth of output has taken place is largely due to increased physical inputs.

In Mehta's study the book value series of data is deflated by price index of capital goods. The weakness of using deflated data alone is that it does not take into account assets of different vintage at different points of time.

In the studies by Ahluwalia (1985, 1991) for the period 1959 to 1985 total factor productivity growth for the registered manufacturing was -0.4 per cent per annum. During the two decades of the sixties and the seventies total factor productivity in the manufacturing sector declined at a rate of 0.5 per cent per annum. However, there is also a finding that in the first half of the eighties productivity growth improved. The dominant source of the acceleration in total factor productivity has been the growth of value added which rose from 5 per cent per annum during the period 1965-66 to 1979-80 to 7.0 per cent per annum in 1980-89. The measure of TFPG used in the study is derived from a Translog production function under the assumptions of competitive equilibrium.

$$\log V(T) - \log V(T-1) = VK[\log K(T) - \log K(T-1)] + VL[\log L(T) - \log L(T-1)] + g$$

where VK=1/ 2[VK(T)+VK (T−1)] and VL= 1/ 2[VL(T)+VL (T−1)] .

VK and VL are income shares of the factors capital and labour, respectively

g=1/2[g(T)+g(T−1)].

The above expression for the average rate of the technical change is referred to as the Translog index of technical change Where V, L, K, TFP and S_L denote value added, labour, capital, total factor productivity and share of labour income in value added respectively.

A check on these estimates is provided by directly estimating alternative specification of the production function. An important feature of the improvement in TFPG in the eighties was that it largely reflected improvements in labour productivity measured in terms of output per workers. Capital productivity, i.e. , output per unit of capital was -0.5 per cent per annum in the period 1980-81 to 1988-89 while for the period 1959-60 to 1979-80 the rate of capital productivity was -2.8 per cent per annum. The capital-labour ratio increased at a rate of 5.1 per cent in the period 1959-60 to 1979-80 and it was 8.0 per cent per annum in the period 1980-81 to 1988-89 while in 1965-66 to 1979-80 it was only 3.3 per cent per annum. Ahluwalia's (1991) study shows that the period of eighties is different as an increase in labour productivity does not only reflect rising capital-labour ratios but represents pure productivity increases as reflected in strong performance with respect to total factor productivity growth as well.

Ahluwalia's study (1991) also estimated production functions. The rich time series cross section data base of the study made it possible to estimate Translog production functions for the manufacturing sector and its use based sub-sectors. The production function analysis shows that there has been negligible and insignificant growth in TFP in manufacturing over the period from 1959-60 to 1982-83 and there is a distinct shift after 1982-83. The estimate for the sector as a whole also suggests that the returns to scale are not constant and that technical progress has a capital saving bias. Among the use based sectors, the hierarchy of TFPG remains much the same as with the growth accounting estimates; the two larger use

based sectors (i.e. intermediate goods and consumer non durables) have performed much worse than the two smaller sectors. The upward shift of TFPG was established in all sectors except in capital goods sector.

A comparison of India's productivity growth performance in the manufacturing sector with other developing economies suggests that India is far behind others. China's productivity performance was as bad as India's. High growth in China up to early eighties is largely due to much greater investment but not due to high productivity growth. As regards relationship between capital labour ratio and TFPG, the econometric analysis reveals that the higher the capital labour ratio in an industry, the lower is its growth in total factor productivity.

The principal source of data for Ahluwalia's study has been ASI. The gross measure of value added is obtained from net value added and depreciation data as given in ASI. Labour input is the total number of persons employed and capital input is measured by the estimates of gross fixed capital stock at replacement cost at constant prices using perpetual inventory accumulation method. Data on net fixed capital stock at book value for the census sector was collected for the year 1960 at the detailed level of disaggregation for (i) land (ii) building and construction (iii) plant and machinery (iv) other equipment. The returns to labour are measured by the total of wages, salaries and benefits (total emoluments), while returns to capital are measured as value added minus the returns to labour. This is done on the assumption that returns to the two factors exhaust the value added in the process of production.

The limitations of the study are infact some of the limitations of ASI data. The survey data are subject to problems of variations in response and therefore, in coverage. The ASI data were deflated using the relevant wholesale prices as deflators.

Ramaswamy (1994) studies size, growth and structure of small scale manufacturing units for the period 1972 to 1991. Data for employment, value added and wages for large scale sector was taken from ASI (Summary Results of Factory Sector and from National Accounts Statistics). Data for small scale industries was taken from census of small scale units

Development Commission. Small scale industries data for total manufacturing employment was taken from census of population. The focus is limited on analysis of industry group, at two digit level only.

The study presents data on labour productivity, real wages and corresponding growth rates for the period 1972-88. Nominal wages for the year 1988 were deflated using Consumer Price Index (CPI) for industrial workers and Wholesale Price Index (WPI) was used to deflate gross value added (GVA). The relevant index numbers were taken from Economic Survey, 1982 and 1990-91. Labour productivity is calculated by dividing GVA by total number of workers. Capital intensity in the small scale industries is measured by book value of aggregate stock of fixed capital divided by total employment.

The basic findings of the study are that the decade of 1980s is characterized by changing structure of manufacturing employment. Non-household employment shows a rise, while household employment shows a declining trend. There is a rise in the share of non-factory segment between 1981 and 1991 from 56 per cent to 65 per cent and the decline *in* the share of the factory sector from 44 per cent to 35 per cent. The study regards non-factory non-household segment of manufacturing as the small scale industry. The SSI sector is found to be a small segment of the manufacturing sector. Its estimated share in total manufacturing employment is found to be 12 per cent and in value added the share is 20 per cent. The SSI has recorded impressive growth rates of employment and value added across industry groups. There is significant increase in labour productivity over the period 1972-73 to 1987-88. Aggregate real labour productivity in the SSI sector increased at the rate above 3 per cent. Capital intensity increased to Rs. 7794/- from Rs. 4819/- in 1972, an increase in 62 per cent in real terms over a period of 15 years. Aggregate capital productivity fell marginally from 1.09 in 1972 to 1.05 in 1988. Wages and productivity are found to be positively related. The study employs wholesale price index for deflating gross value added and not the industry specific indices. Moreover, the study uses book value of aggregate stock of fixed capital for calculating capital intensity.

A survey was undertaken by the National Productivity Council (NPC) during May-June 1994 with the objective of assessing the impact of economic reforms on the performance of Indian organization. The survey reveals some important facets of the ongoing economic reforms in India. The reforms encouraged exports from the country. The enterprise managers were found to enjoy more functional autonomy. The most encouraging revelation of the survey perhaps concerns the labour aspects. The labour productivity of a large number of organizations has increased during the period of reforms. Labour productivity is a crucial factor for survival and growth in industries especially in a country like India where most of the industries are still labour intensive. The survey reveals that reforms have brought in significant improvement in enterprise level labour productivity. As high as 85 per cent of the organizations responded that their labour productivities improved in the post reform period. Nearly 48 per cent of the responded companies recorded impressive, i.e., above 3 per cent per annum improvement in productivity during the period, while another 28 per cent reported moderate, i.e., 0.5 to 3 per cent per annum increase in productivity. In 9 percent of the companies labour productivity increased marginally, i.e., up to 0.5 per cent per annum and in another 9 per cent, it remained constant. In 6 per cent of organizations labour productivity declined. Productivity estimates are sensitive to the measure of value added that is adopted. One source of bias in estimation is due to the assumption often made of constancy of the relative price of material inputs.

Balakrishnan and Pushpangadan (1994) argued that appropriate measurement of value added is a prerequisite for the estimation of productivity. This study attempts to construct a standard measure of productivity for Indian industry having accounted for changes in relative price of material inputs.

The period of study was 1970-71 to 1988-89. The relative price of law materials remained more or less stable till the late 1960s; therefore the period of study is restricted to 1970-71 to 1988-89. The ASI was not published for the year 1972-73. For continuity the value of 1972-73 were estimated as a simple average of figures for 1971-72 and 1973-74. Gross value added had been used in the study. For Value Added Single Deflation (VASD) this figure has been deflated by index of the price of output. In case of Value Added Double Deflation

(VADD), the value of inputs is deflated by the price of inputs and the resulting value deducted from the real output (nominal output deflated by the price of output). WPI of manufacture (1970-71=100) is treated as the price of output. The material price index is a weighted index of wholesale prices of major input groups, the weights having been calculated from the matrix of input-output transactions published by CSO. Inputs were grouped according to the availability of wholesale price indices that could be used to represent them most closely. The implied weights were used to contract a weighted average input price. Perpetual inventory method was followed for generation of capital stock. The year 1960 is taken as benchmark year as for 1960, Hashim and Dadi (1973) provide the ratio of purchase value to book value of capital. For land gross net ratio (GNR) was assumed to be unity. For other three groups GNR is taken from Hashim and Dadi (1973). To adjust for age structure, the estimate for each year is then inflated using current to purchase price ratios to obtain gross fixed capital at replacement cost in 1960 price. The investment figures were obtained using the formula:

$$I_t = (B_t - B_{t-1} + D_t) / R_t$$

Where B is the book value of fixed capital; D depreciation and R is an appropriate deflator for fixed capital. The capital stock is calculated as follows:

$$K_t = K_O + \sum_{t=1}^{T} I_t$$

Where I_t is investment in t year and Ko is the capital stock in benchmark year in 1960 prices. As the study is motivated by the argument that appropriate measurement of productivity requires commencement from estimates of value added, adjusted for changes in the relative price of raw material inputs, so the focus is on the difference in estimated productivity arrived at by single deflation and double deflation methods respectively. Ahluwalia has argued that there is a turnaround in total factor productivity growth in 1980. Balakrishnan and Puspangadan's statistical analysis confirms a 'turnaround' if TFP estimated is derived from the VASD series. The point, however, is that if TFP index is derived by double

deflation there is absence of an increase in the growth rate of TFP. The results indicate that, contrary to what is believed, productivity growth in the 1980s may actually have been slower than in the earlier decade.

Dholakia and Dholakia (1994) feel that Balakrishnan and Puspangadan's (1994) statistical analysis is based on registered manufacturing sector only while the input-output table used here is based on inputs and outputs of entire manufacturing. Balakrishnan and Puspangadan reworked the exercise using 1981-82 prices and input coefficients for the year 1983-84. The results do not support the claim of higher rate of growth of TFP since 1980. Despite the introduction of a new set of input price deflators, the original results survive. Balakrishnan and Puspangadan point out that the question of productivity growth in Indian Manufacturing Sector is far from settled. First, there is the question of productivity itself. Three recent studies by Mohanty (1992), ICICI (1994) and Srivastava (1996) report conflicting results. Mohanty (1992) reports a deceleration in TFP growth in the 1980s. Mohanty reports declining productivity in the presence of improved growth of value added. ICICI (1994) reports negative growth till 1987, after which a turnaround is reported. The results reported by Srivastava (1996) are non conclusive when the growth accounting method is followed, total factor productivity decelerates and is negative after 1985-86, the year seen by Srivastava as coinciding with liberalization on the other hands when a production function is fit, a higher growth of total factor productivity follows from 1985-86. Dholakia and Dholakia (1994) provide a numerical example of the possibility of negative value added double deflation. Rao (1996) points out that single as well as double deflation methods used for deflating value added have measurement bias.

Dholakia and Dholakia (1994) study TFPG for Indian manufacturing from 1970-71 to 1988-89 using double deflation method and points out that the Balakrishnan and Puspangadan (1994) study has a number of limitations (a) the study is based on ASI data, but remains silent on the adjustments for non reporting units; (b) presence of aggregation bias in using weights from input-output transaction table which is further aggregated to from 19 input groups, may distort the results and (c) Balakrishnan and Puspangadan (1994) study

considered a large part of registered manufacturing sector. The I-O table is based on the inputs and outputs of the entire manufacturing sector which introduces significant bias.

The basic problem in estimating real value added by double deflation method is the estimation of an appropriate price index for material inputs. The weights attached to each input group play a significant role in the determination of overall input price index. This study gives three alternative series of weights CSO (1973-74), Balakrishnan and Puspangadan (1994), WPI (1970-71) and CSO (1973-74) registered manufacturing industries differ significantly from one another and Dholakia and Dholakia consider the set of weights estimated by them using 1973-74 input-output matrix adjusted for only registered manufacturing sector to be the most appropriate for estimating TFPG in registered manufacturing sector in India. To show sensitivity of TFPG to the weights used for input groups in the double deflation method, Dholakia and Dholakia estimated real value added in manufacturing sector and imputed growth rates using the three sets of weights.

The study reports that the annual growth of real value added in the Indian registered manufacturing sector when measured through single deflation method shows remarkable acceleration during the 1980s as compared to the 1970s (from 3 per cent to 8 per cent). If, however, the same is measured through double deflation method, the acceleration in growth rate is found to be (i) much higher in the 1980s as compared to 1970s (3.5 per cent to 11.2 per cent) when the weights for the 19 inputs groups based on WPI (1970-71) are used; (ii) negligible during the 1980s as compared to 1970s (7.5 per cent to 8.1 per cent) when weights for the whole manufacturing sector as considered by Balakrishnan and Puspangadan (1994) are used; and (iii) lower in magnitude but significant during the 1980s with 9.8 per cent growth as compared to 5.9 percent during the 1970s when weights for only the registered manufacturing sector as estimated by Dholakia and Dholakia are used. Thus the estimates of TFPG by using double deflation are sensitive to the weights used.

Hence the study reveals that the estimate of TFPG for the decade of 1970s is negative. It is around – (1.5) to – (1.7) per cent when traditional single deflation method is used to measure the real value added in the Indian Registered Manufacturing sector. During the eighties

TFPG with the method of single deflation turns out to be around 1.9 to 2.0 per cent. Thus, when single deflation method is used TFPG shows remarkable acceleration of about 3.5 to 3.6 per cent points during the 1980s as compared to 1970s. On the other hand, when double deflation method is use to measure value added in Indian manufacturing sector using WPI (1970-71) weights there is an acceleration in TFPG of about 5.8 percentage points from 1970s to 1980s but when weights for whole manufacturing sector alone are used as by (Balakrishnan and Puspangadan) there is a deceleration in TFPG of 0.8 percentage points from 1970s to 1980s. However, when weights for registered manufacturing sector only are used there is a much subdued acceleration of about 2.3 percentage points in TFPG from 1970s to 1980s. So Dholakia and Dholakia's study reports that a refinement in the method used by Balakrishnan and Puspangadan confirms the hypothesis of turnaround in TFPG in Indian registered manufacturing since 1980.

Dholakia and Dholakia's study also points out that the double deflation method would provide different answers for different base years for constant prices, whereas the single deflation method gives a unique answer. Technically also the method of double deflation required dealing at the most disaggregated level which is often not feasible. Even when the double deflation is feasible with complete disaggregation available, the possibility of negative 'real' value added still remains. So the study suggests the use of single deflation as is commonly used to get real value of an aggregate defined in terms of difference between two other aggregates. Balakrishnan and Puspangadan (1994) want Dholakia and Dholakia to be more explicit about the data across the board.

The study by Kannan (1998) takes a critical look at the political economy of labour and development by examining the roles of labour unions, state, and capital in Kerala. The three dilemmas relate to:

(i) technological choice in the face of high and rising labour costs in labour-intensive activities for maximizing long-term growth and employment,

(ii) mismatch between labour-supply and labour demand as a result of changing job expectations of the younger generation in a technologically stagnant economy, and

(iii) lack of new investment despite growing loan able funds and declining resistance to technological change. The failure of labour unions to agree to productivity improvements through technological changes and increasingly resorting to 'closed shop' strategies has been particularly emphasized.

Results of the study revealed that from the perspective of labour in general and rural labour in particular, Kerala's record in achieving a measure of human dignity and social progress is remarkable, especially if viewed in terms of all-India context. The progressive and degrading conditions, still prevalent in many parts of rural India, involving organized violence by landowning classes, indignities to women workers, and degrading conditions of work are no longer the story in Kerala. The emergence of trade unions as a strong labour institution and the overall social progress has led to a remarkable decline in the incidence of child labour, social acceptance of certain work norms as eight hour work, intervals and formal labour relations as against patron-client relations.

Study by Hulten and Srinivasan (1999) found that there were other positive impact of reforms on investment, labour productivity and capital per worker.

According to Sen (1999) processes of economic globalization have significantly transformed labour markets in Asia during the last three decades. A central feature of this transformation is the growing importance of female labour at the core of economic processes. This feature has been extensively discussed by feminist economists and anthropologists, but received relatively little attention in macro-policy debates. At best, policies towards women workers are viewed as welfare measures of primary interest to the women themselves. The researcher argues that such a view is short-sighted and its limitations are becoming evident in the context of the recent economic crisis. Gender-biased or "gendered" labour markets, as researcher calls them, are not only a problem for women workers. They also trap economies on the so-called low road of labour-intensive growth, making it difficult to garner the full fruits of growth, or to ensure its sustainability. Sustainable human development focused on the conditions of women's participation in labour markets can lay a firmer grounding for sustained increases in income per capita. Sustainability in the study is viewed along three

dimensions: human development, the gains from trade and integration into the global economy, and resilience in the face of economic shocks such as the recent crisis.

The study by Acharaya attempts to deal with the structural changes and growth of employment in different group of industries, in the organized sectors and ranking of states according to their organized industrial development index at three different points of time 1987-88, 1993-94 and 1997-98 covering seventeen major states in India. It is evident from the study that within every state, shares of different groups of industries have undergone significant changes. The whole study is based on secondary sources of data. The data source for the organized sector industries is the 'Annual Survey of Industries (ASI)'. The objective of researcher is to know the potential of different groups of industries in creating employment, and for that the study analyses the growth rate of employment in different groups of industries in the two periods: 1987-93 and 1993-97. The researcher found that the huge changes have occurred in the employment pattern of the organized sector of Indian industry. Within every state, shares of different group of industries have undergone much change. It has been shown that growth in employment in many groups of industries is not always leading to a rise in its share. In the race for industrial development, some states are far ahead of others. So, much change is well perceptible in the structure and the growth of the organized sector employment.

This study by Manning (2000) focuses on labour market adjustments during the economic crisis of 1997–98. It shows how labour processes help explain better out comes for the poor than were initially predicted. The Indonesian experience is viewed in a framework that contrasts two extreme models: a Keynesian world of rigid real wages, and a neoclassical situation of flexible adjustment to economic shocks. It was found that the Indonesian case is more consistent with the neoclassical than the Keynesian model, despite the tendency for greater government intervention in labour markets before the crisis.

The result depicts that the large change in relative prices from the exchange rate depreciation had a smaller effect than expected on employment structure. These conclusions are discussed in the context of major changes in labour markets prior to the economic crisis.

The study by Tendulkar (2003) attempts to examine the changes in the organized labour market in India before and after the economic reforms of 1991. With this objective, the researcher provides the magnitude and overview of the entire Indian labour force for the recent year 1999-2000. The researcher discussed the concept of organized work force. In usual parlance, the term 'organized' is used to indicate a unionized segment of work force. In this study, organized work force is defined to include only those workers having regular, contractual hired employment. The objective of the researcher is to examine the whole changes in organized labour market in India before and after the economic reforms of 1991. The empirical examination shows, that organized workforce has shrunk in relative magnitude. Organised-unorganised duality in Indian workforce has increased over the years due to the restrictive trade and investment policies with added emphasis on expansion of the public sector which has failed to design economic organization and system of incentives and punishments to induce dynamic and technological adaptations and to promote necessary control on cost and quality.

Goldar's study (2003) covers the period 1951-79. The period 1951-79 has been divided into two sub-periods 1951-65 and 1959-79. The sub period 1951-65 covers both CMI and ASI data and the second sub-period is based exclusively on ASI data. Goldar computed both partial and total factor productivity indices for manufacturing sector as a whole. Goldar's study uses Kendrick index, Solow index and Translog index of total factor productivity.

During the period 1951-65, the labour productivity and capital intensity showed an upward trend. The capital productivity recorded a decline of 1.14 per cent per annum. The average annual rate of growth was 1.27 per cent per annum during 1951-79.

In the second sub-period (1959-79) Goldar has observed similarity in the result of partial productivity and capital intensity as in the first period. Goldar's estimates of TFPG for a composite sector including large scale registered manufacturing sector tend to be relatively higher than other estimates. The average annual rate of growth in case of the Translog index was of the order of 1.31 per cent per annum. This was also higher as compared with Solow

and Kendrick indices which were of the order of 1.29 and 1.06 per cent per annum. Goldar's estimate for small scale registered manufacturing is very similar to that for the large scale, i.e., 1.2 per cent per annum. Accordingly, Goldar has concluded that technological progress has contributed to output growth, though marginally, and growth in total factor productivity is sluggish.

Goldar also analyses the relationship between import of technology and productivity growth in Indian industries. Scherer (1982, 1983), Griliches (1984) and others have shown that technological advancement is a major source of productivity improvement. These studies concluded that the rate of improvement in productivity achieved by a firm or an industry depends on research and development efforts of the firm/industry. Technological advancement is usually a major source of productivity improvement. But in Indian industries while there has been a significant inflow of advanced technology, there has been no appreciable rise in productivity. The failure of Indian industries to take adequate advantage of technology imports may be attributed to low volumes of production (small size of domestic markets), the government imposed phased manufacturing programmes, low research and development intensity of the domestic manufacturing firms and slow progress in the development of indigenous technological capabilities. According to this study liberalization would go a long way in easing the difficulties faced in expanding the potentialities of efficiency improvement offered by imported technology. In the new emerging economic environment, characterized by greater openness and competition, one would expect greater inducement for local research and development efforts and developments of indigenous technological capabilities.

In Goldar's study work, two series of estimates are presented: one for the period 1951-65 and other for the period 1959-1979. The first series combines CMI data with ASI data. The two data sources are incomparable on various counts. ASI covers 63 industries, while CMI only 29. Although data adjustments have been made for 28 comparable industries but still some problems of comparability of data remain. The study uses a more aggregative deflation procedure (total value added at current prices is deflated by WPI of manufacturing).

The study by Tiago *et al.* (2006) discusses the secular rise in female labour force participation, highlighted in the recent macroeconomics literature on growth and structural change, has been associated with the declining price and wider availability of home appliances. This paper uses a new and unique country dataset on the price of home appliances to test its impact on female labour supply. The researchers assess the role of the price of appliances in raising participation by comparing it to other structural determinants such as average male income. A decrease in the relative price of appliances - the ratio of the price of appliances to the consumer price index - leads to a substantial and statistically significant increase in female labour force participation. In the United Kingdom, for instance, the decline in the relative price of home appliances accounts alone for about 10 to 15 percent of the increase in female labour force participation from 1975 to 1999. This result is robust to the inclusion of additional controls, such as: country dummies, time trend, government spending, capital to output ratio, and the growth rate of real GDP. To assess causality, the researcher test for exogeneity and use the manufactured price index as an instrumental variable, confirming that lower appliance prices lead to increased female participation.

The study by Ken *et al.* (2006) examines specific features of structural change in the UK since 1997, contrasting the decline in industrial jobs with the rise in a variety of service jobs. It examines the proximate causes of structural change, in particular whether the chronically slow growth of manufacturing output in the 1980s has persisted. The implications of this structural change are considered, particularly the effects on the balance of payments and regional employment patterns. The study suggests that the main impact of government policies on regional employment may have been through the direct and multiplier effects of public expenditure.

The study by Shi (2006) introduces a global demographic sub-model, from which emerge the global implications of these changes for population sizes, age distributions and gender compositions. Corresponding changes are inferred in labour force size, and in patterns of consumption and saving and these are then analysed by incorporating the demographic sub model into a correspondingly global economic model, based originally on GTAP-Dynamic, in which regional households are disaggregated by age group and gender. As an application

of the combined model the effects of increased longevity are explored on a global scale. Growth in real per capita incomes is slowed by this change, average saving rates fall and the distribution of global economic activity alters to favour those regions with high aged labour force participation.

According to Davis (2006) a heterogeneous labour force serves to attract new food manufacturing investment. The researcher conduct analysis for SIC 20, Food and Kindred Product Manufacturing, and disaggregate analysis on all nine three-digit SIC food industries. Heterogeneity variables are a significant factor in nearly all specifications. The researcher also examines the factors that create the greatest increases in the expected number of new establishments. Areas with a high degree of labour heterogeneity are found to have large advantages. Labour heterogeneity is among the most important factors attracting food manufacturing to urban areas over rural areas.

Mahmood (2006) examines the relationship between labour productivity and employment in Australian manufacturing small and medium enterprises (SMEs). The researcher indicates that labour productivity of SMEs varies substantially between industries within the manufacturing sector, but on average labour productivity for manufacturing SMEs increased at a faster rate than that of large manufacturing enterprises across all industries. All manufacturing industries, except one recorded employment growth during the period under study. However like labour productivity growth, employment growth also varies across industries within the manufacturing sector. Yet the study could not establish any definite relationship between labour productivity growth and employment. This finding is consistent with some previous studies.

The study by Lakshmanan (2007) provides an analytical abstract of various parameters of manufacturing competitiveness of the Indian economy. India's manufacturing exports have risen impressively in the past decade or so and found to be directly linked to the world GDP and inversely related to real effective exchange rate (REER). Indian manufacturing industries have certain inherent strengths and advantages in having a relatively inexpensive, adequate and skilled labour force, cost-effective and competitive prices of goods produced, large

manufacturing base and proximity to fast growing Asian markets. India is one of the leading producers and exporters in a number of commodities and enjoys significant advantages in terms of lower labour costs as compared to other economies. Nevertheless, India's competitiveness is lost on account of lower labour productivity and higher input and material costs. To improve the competitiveness of the Indian manufacturing goods, issues like further diversification of export basket, up gradation of export quality, improvement in productivity, increased technology intensity in production, enhanced R&D activity, encouraging business environment, less cumbersome regulatory environment, flexible labour laws, removal of infrastructural bottlenecks and SME related issues need attention of all concerned.

According to Bhalla (2007) a review of the current debate on the impact of globalization on employment, poverty and inequality in developing countries reveals that the predictions of the given trade theories that increased trade and FDI consequent to globalization would result in higher employment in labour surplus economies has not always proved correct. Even in the developed countries, there is a growing unease due to doubling of global labour force because of the entry of BRICS into the trading system. In the Indian context of post economic reforms, the rate of growth of the economy and the rate of growth of employment have accelerated, but the economy as also employment remains undiversified. Both interpersonal and inter-regional income inequalities remain high and seem to have increased. The quality of employment remains very poor for a major portion of workers and the conditions of work seem to have deteriorated in terms of social security and other amenities.

Nagraj (2007) reports an acceleration of economic growth close to 6 per cent on a trend basis over the last quarter century – up from 3.5 per cent per year during the first 3 decades of post independence period. The results depict that employment growth has remained tardy. This area of research has always captured the interest of researchers have deteriorated in terms of social security and other amenities.

The aim of Varela *et al.* (2007) was to explore the determinants of productivity and productivity change in the Moroccan economy, with a particular interest in examining the role of international trade in impacting upon productivity levels. Methodologically the

researchers undertake a two-stage approach. In the first stage the researchers estimate productivity at the firm level. In the second stage the researchers regress those estimates of productivity on a range of explanatory variables. In this work, where possible, they use both the econometric and the index number approaches for estimating productivity. This allows us to compare the robustness of the results across the different methodologies.

The second stage of the work was concerned with understanding and explaining the differences in productivity across the firms/sectors, and of the role of trade liberalization in this. This involves regressing the differences in productivity on a range of key explanatory variables. This analysis was carried out at both the sectoral and the firm level, and for different time periods.

The results suggest that changes in firm level productivity are relatively modest (in particular in the latter half of the period), and that there are quite considerable changes in aggregate productivity arising from a relatively high degree of entry and exit of firms, and from changes in the shares of incumbent firms. The results also indicate that the relationship between key variables such as import or export openness can vary importantly according to the size (class) of the firm.

Overall the results in this paper suggest that engaging in a process of trade liberalization via the Barcelona process is likely to lead to changes in the productivity of Moroccan firms, and thus have a positive impact on GDP per capita. However, the impact on productivity will vary both by sector and by firm type, which in turn suggests that there will be distributional considerations for policy makers to bear in mind. Where in this research we have shown the importance of dealing with firm level heterogeneity in understanding productivity change – future research needs to focus more directly on the transmission mechanisms. This is important for better understanding the conditions under which firms are more likely to be successful, and the constraints they face.

Mitra (2008) investigate the determinants of productivity in Indian manufacturing industries during the period 1989-2000. Using two-digit industry level data for the India states, the

researcher found evidence of imperfect interindustry and interstate labour mobility as well as misallocation of resources across industries and states. The researcher found that trade liberalization increases productivity in all industries across all states. Productivity is also found to be higher in the less protected industries. The effects of protection and trade liberalization are more pronounced in states that have relatively more flexible labour markets. Similar effects are also found in the case of employment, capital stock and investment. The researcher also found that labour market flexibility, independent of other policies, has a positive effect on productivity. Importantly, per capita state development expenditure seems to be the strongest and the most robust predictor of productivity, employment, capital stock and investment. Finally, industrial delicensing increases both labour productivity as well as total factor productivity but only in the states with flexible labour market institutions.

Shepherd (2008) uses the industry of origin approach to analyze value added and labour productivity outcomes arising from progressive liberalization of government and from statutory board control of transport and communications in Singapore. The paper compares these outcomes with those from the market-orientated, more privatized transport and communications sector in Hong Kong, for the benchmark year 2004 and a review period from 1990 to 2005. The study is among the first to carefully compare labour productivity in specific sectors between the two countries. Although Singapore generally recorded higher levels of labour productivity, there was some catch-up by Hong Kong in the later part of the review period. There was also substantial variation in labour productivity performance within sectoral branches in the two sectors. The study suggests there is some evidence that the different political–economic structures and policy approaches to deregulation and liberalization played a role in determining productivity performance in the transport and communications sectors in Singapore and Hong Kong. The analysis infers a potential, increasing focus on privatization as the driving force for further liberalization of the transport and communications sector in Singapore.

2.1.2 Studies on the Unorganized Manufacturing Sector

Very few studies have been done on unorganized manufacturing sector:

Study by Rajan (1997) discusses social security programmes for the disadvantaged elderly population in the unorganized sector in three South Asian countries: India, Sri Lanka and Bangladesh. Owing to data constraints, the discussion is limited to social assistance, old age homes, and pensions. The analysis suggests that both the State and private voluntary organizations have played only a limited role in providing social assistance in old age. The outcome is inadequate coverage and funding for the programmes designed to assist older persons. Because of rapid ageing, if the current situation is allowed to prevail, the outcome will be even less promising. Increased coverage and funding require greater focus on achieving higher economic growth rates and improving the fiscal management of public expenditure.

According to Nandal (2006) a vast majority of India's labour force is in unorganized sector. In the absence of economic opportunities in their own states, many workers migrate across the other states of India to seek employment. Construction industry depends almost entirely on migrant workers, majority of which are women. The main object of this research has been to shed light on the socio-economic problems being faced by a section of the women workers in construction industry. These women workers have a very tough life. In spite of being actively involved in economic activities for survival, bearing and rearing of children remain their prime responsibility, and thus they end up with playing roles in both production and reproduction.

Lakhwinder and Jain (2006) study the growth profile of Punjab's unorganized industry by looking first at its size structure, followed by nature and growth of industrial activity.

The researchers found that the textiles, food products and beverages, fabricated metals, other non-metallic minerals, bicycle industry are grown in Punjab during the 1990's. But the

industry group like the manufacturing of machinery and equipments have recorded a decline trend in Punjab unorganized manufacturing sector.

Dhas (2008) argues the basics of globalization, the economic reforms initiated in India and the trends in employment and the impact of globalization. It is argued that the unorganized workers would expand further due to globalization. Under the present deprived conditions of unorganized sector, this would lead to imbalance in the labour market leading to more supply of labour, low wages and low level of income. This situation would affect the social and economic conditions of the unorganized working population. The unorganized workers will be in the highly disadvantageous position as there would be a shift in the technology from labour to capital intensive and use of unskilled to skilled worker.

This study uses the industry of origin approach to analyze value added and labour productivity outcomes arising from progressive liberalization of government and from statutory board control of transport and communications in Singapore. The study compares these outcomes with those from the market-orientated, more privatized transport and communications sector in Hong Kong, for the benchmark year 2004 and a review period from 1990 to 2005. The study is among the first to carefully compare labour productivity in specific sectors between the two countries. Although Singapore generally recorded higher levels of labour productivity, there was some catch-up by Hong Kong in the later part of the review period. There was also substantial variation in labour productivity performance within sectoral branches in the two sectors. The study suggests there is some evidence that the different political–economic structures and policy approaches to deregulation and liberalization played a role in determining productivity performance in the transport and communications sectors in Singapore and Hong Kong. The analysis infers a potential, increasing focus on privatization as the driving force for further liberalization of the transport and communications sector in Singapore.

Although studying the trends in unorganized sector is not to the purview of this research, however a reference needs to be given on the unorganized sector as it helps in giving an overview of the Indian labour market as a whole. The present study will try to analyse the growth trends in Punjab manufacturing in Value added, Labour and Capital growth,

Productivity and Capital intensity at a disaggregative level for two digit industries. Moreover the study will try to cover the period 1981-2005 and two sub-periods, period -I 1980-1992 and period -II 1993-2005 to study the trends in pre and post liberalization period.

2.2) Observations Based on the Review

The review of earlier studies shows that research done till data is focused around the dimensions like economic growth and labour force. Some important studies and certain following issues that emerge from the review of studies are:-

(i) Almost all studies conducted the structural changes and growth of employment in the organized sector.

(ii) Little attention has been paid in these studies to the explanation of the observed female labour. Sen and Tiago argue that processes of economic globalization have significantly transformed labour market in Asia. Feature of this transformation is the growing importance of female labour at the core of economic processes. And the secular rise in female labour force participation has been associated with the declining price and wider availability of home appliances respectively.

(iii) Goldar and Ahluwalia cover the total factor productivity growth in Indian organized manufacturing in different periods of time.

(iv) Beri, Chatterjee, Ramaswamy studied only labour productivity at the different period of time. Mahmood examines the relationship between labour productivity and employment in small and middle industries (SMEs).

(v) Rajan, Nandal and Dhas examine the labour factor in the unorganized sector.

(vi) Shepherd, Lee, Gasiorek, Augier, Varela and Mitra cover the determinants of labour productivity.

2.3) Objectives of the Study

After the review it can be said that there is ample slope of research in most of the studies are either to aggregative or sector specific.

The study has been undertaken with following broad objectives:

- To analyze the growth rates of labour force and labour productivity in manufacturing sector of Punjab for the period 1980-2005 and also for two periods period-I, i.e., 1980-1992 and period-II the post-liberalization period i.e., 1993-2005.

- To study the structural changes and employment growth at two-digit level in the organized manufacturing sector.

- Impact of globalization on structural changes in labour force and labour Productivity in organized manufacturing sector.

- To study the impact of technology on labour and labour productivity in the pre and post globalized period.

- To analyze the factors affecting labour productivity

CHAPTER-III

MODEL AND METHODOLOGY

In this chapter the model and methodological issues in the measurement of the productivity have been discussed. The chapter is divided into five sections. Section 3.1 describes the concept of productivity. Section 3.2 deals with the variables of the study. Section 3.3 describes the determinants of productivity. Section 3.4 deal with the data sources and section 3.5 discusses the methodology used in the present study.

3.1) Conceptualisation of Productivity

An essential prerequisite of a sound statistical analysis is that all terms involved in the interpretation are precisely defined and their scope is delimited. The term "productivity" has been used in such a variety of senses, that it is exceedingly difficult to find out whether the term 'productivity' is synonymous with 'efficiency' or 'overall effectiveness' of a productive unit: be it a plant, firm or a company. Productivity is an elusive concept that does not lend itself either to clear cut definition or easy computation. Productivity is a subject surrounded by considerable confusion people employ the same term and mean different things (Fabricant 1969). Productivity is a word which we use broadly to express the overall efficiency relating to performance of industries. Smith, A. (1776) referred to efficiency and specialization, what in current nomenclature amounts to the concept of productivity. Although there is no consensus on the definition of productivity yet everyone accepts it to be a measure of performance. No amount of economic juggling can alter the fact that in the long run, our solvency depends on the efficiency of our industries. Productivity is the key feature of economic dynamism today. Kuznets (1966) had pointed out that rapid growth in industrial productivity was an essential element in the development and structural transformation of the newly developed economies. In a broad sense, productivity means goods and services produced in relation to the resources utilized in producing the same. Productivity means utilizing appropriate resources, avoiding wastage, producing more with same constituents

while preserving quality. Thus, productivity becomes a path of process and raising productivity becomes a condition of material progress.

3.1.1) Partial Productivity

Productivity, when defined with respect to any one input ignoring other factors in the output-input ratio is termed as partial productivity. Partial productivity reflects the relative efficiency of the factor used; the effect of factor substitution as well as of changing productive efficiency.

Partial productivity is classifiable, according to factors, as:

a) Capital productivity;

b) Labour productivity.

3.1.1 (a) Capital Productivity

It is defined as the ratio of output to capital resources expended. In the determination of performance of the economy, of late, much attention has been paid to the value of capital-output ratios. The concept of capital used here relates to gross fixed capital. It includes plant, equipment, buildings and construction.

The ideas of capital consumption allowance, calculation regarding replacement amount of capital, average life of capital goods, net stock, gross stock, rates of depreciation, correction of historical costs of components, replacement, cost accumulated expenditure on investment etc. have come up from time to time to transform capital as an input measure, which can be used as meaningful denominator in productivity measurement. Moreover, the statistics available of capital input are not free from inherent defects and vary from one source to another, so much so that the results show a marked difference and often lead to dubious outcomes and misguide the researchers.

3.1.1 (b) Labour Productivity

Although a number of variables combine to affect changes in productivity, yet it is necessary that a particular yardstick of input factor be chosen that manifests in all type of production. It is generally believed that number of workers or man-hours worked should be used as an input factor. When output is divided by number of workers or man-hours the result is termed as labour productivity.

Several points are made in defence of the choice of labour man hours or in defence of the number of workers employed in calculation of productivity. Labour force in any country is one of the most important resources. Adequate supply of skilled and efficient labour is a great asset. Another, but in no way less convincing argument in favour of this measure, is that labour time is more readily measurable than other input factors and that is possesses a universal element common to all plants, processes and industries. This universality provides a common basis for measuring and comparing the relative productivity, not only in different units but also of different sectors of a country.

This definition, despite its simplicity and widespread usage, has not removed confusion either from analysis of interpretation and the reasons for it are manifold. It is difficult to dislodge the deep rooted notion from the mind of common man, inexperienced in the technique and methodology of productivity of analysis that labour productivity data measure the productivity of labour and not the productivity of all the combined input factors. Indeed, it would be difficult to visualize a situation in which a country can achieve higher standard of labour productivity despite its comparatively low standard of labour efficiency. Seigal (1961) says, “Labour productivity indices do not reveal changes in the intrinsic efficiency of labour, but rather the changing effectiveness with which labour is utilized in conjunction with other factors”. As such labour productivity is not a measure of specific contribution of labour or of any one factor of production: it reflects the cumulative influence of operation of a large number of interrelated influences such as technological improvements, the rate of operation, the degree of efficiency achieved in different processes, the availability of supply and the flow of materials and components, as well as employer-employee relations, the skill and

effort of workers as well as the efficiency of management. This is the reason to present study confines to measuring labour productivity and its determinants.

3.2 Variables of the Study

3.2.1) Measurement of Output

Gross value added at constant prices is taken as the measure of output in the present work. The gross measure of value added is obtained from the value added and the depreciation data as given in Annual Survey of Industries. The data on gross value added is deflated using the industry specific wholesale prices (at 91-92 prices).

In the measurement of output an important choice arises between value added and gross output. The former option leads to a notion of total productivity while the latter gives rise to the widely deployed measure of total factor productivity. The choice hinges on whether one believes the production function to be separable in material inputs and factor input. A majority of the earlier studies have preferred the value added measure. Griliches and Ringstad (1971) advance the following arguments in its favour:

a) It facilitates comparison of results for different industries with different material intensities;
b) It facilitates aggregation of output across industries; and
c) Inclusion of 'material' as an argument in the production function leads to the problem of dominant variable. In such a formulation almost all variation in output tends to get explained by 'material' thereby obscuring relations of greater interest.

Bruno (1978) and Diewert (1978) analyse the biases inherent in using single and double deflated value added in place of the correct output in production function and total factor productivity (TFP) studies. It has been shown that functional separability, fixed intermediate input proportion and constant relative intermediate goods prices are three possible hypotheses which, if satisfied may lead to a justification of the use of 'value added'. Danny

and May (1978) test these hypotheses for Canadian manufacturing and reject each of the three. Regarding the measurement of TFP, Bruno points out that the use of single deflated value leads to a biased estimate. Denison (1969) regards both gross and net measures as legitimate for productivity analysis. Denisom, however, prefers the net measure as "gross products are larger by the value of capital consumption". There is no reason to wish to maximize capital consumption. It may however be pointed out, that from the data available to us it is extremely difficult to make a proper estimate of capital consumption. The figures on depreciation that are presented in ASI are at the rates allowed by income tax authorities and are seldom representative of the true capital consumption. So gross value added is used in this study for analyzing productivity trends.

The study uses single deflation method as getting suitable deflators for materials considering its severe heterogeneity is a rather difficult task. The method of double deflation requires dealing at the most disaggregated level which is often not feasible CSO (1980:26); CSO (1989:84). Any grouping can lead to serious errors. The estimates of real value added are highly sensitive to the set of weights used to arrive at the overall input price index. Moreover, Dholakia (1994) points out that even if we consider the case where double deflation method is feasible with complete disaggregation available, the possibility of negative real value still remains.

3.2.2) Labour Input

Regarding the measurement of labour input there are three alternatives available: (a) man-hours; (b) workers and (c) employees. The present study uses the number of employee's data from Annual Survey of Industries for the period 1980-81 to 2004-05. Denison (1961) disfavours in man-hours as a measure of labour input, as reduction in man-hours per week leads to an increase in labour input per hour. Thus, measuring labour by the number of persons is more satisfactory. Total employees as a measure of labour input include both workers and persons other than workers. Employees include supervisors, technicians, managers, clerks and other similar types of employees. It has been argued that such employees are as much important for getting the work done as the workers who operate the

machines and therefore their services should be taken into account in the measurement of labour input. Data for employees after 1980 is reported in the Annual Survey of Industries, under the heading 'total persons engaged'. The share of total emoluments in value added is taken as the share of labour. Wholesale price index is used to deflate total emoluments. Assuming constant returns to scale, the share of capital is got as one minus the share of labour.

3.2.3) Capital Input

In spite of its important place in economic theory, capital is the most difficult concept to deal within empirical context. There are statistical and conceptual problems involved in its measurement. The problem of defining and measuring capital is hardly settled as yet. Productivity analysis and growth would not be possible unless one agrees on some definition and method of measuring capital in practice. Considerable differences are observed with regard to the measurement of capital input. The difference in labour productivity estimates between studies may be attributed largely to the difference in capital estimates.

According to Du Plooy and Jackson (1995), capital is made up of many inputs – they include land and buildings, plant and equipments, and inventories. Capital is the stock of all the goods in a firm at any moment of time whether they are fixed assets like machines and buildings or circulating assets like consumable stores.

3.3) Determinants of Labour Productivity

Labour productivity depends on the ability of worker, the willingness, capital intensity, the system of wage-payment; all these influence the efficiency of labour. The worker's attitude and behaviour are influenced partly by the system and partly by his morale, feeling of responsibility, general outlook to life and trade union practices and attitudes. The system of wage payments undoubtedly exerts an important influence on the worker's urge to produce more.

The relationship of labour productivity with all the variables can be represented by an equation of the form:

$$Y = F (X_1 , X_2 , X_3 , X_4 , X_5 , X_6)$$

Where X_1 is output growth;
X_2 is capital intensity;
X_3 is investment;
X_4 is growth in number of factories;
X_5 is scale variable and
X_6 is total emoluments.

The present study uses ordinary least square regression and step wise regressions to fit in the above mentioned model. The time period for the analysis is 1980-81 to 2004-05. The dependent variable is labour productivity growth. Labour productivity is a comprehensive measure of productive efficiency. In this chapter an effort is made to explain the factors affecting labour productivity growth. The variables used in the model are discussed below:

1) Rate of Growth of Output

Rate of growth of output is an important determinant of productivity as productivity is measured as a ratio of output to input. So, higher rate of growth of output should lead to higher labour productivity of the industry. The movements in labour productivity have normally a specific relationship with movements in output. Verdoorn (1949) examined the empirical relationship by estimating the equation of the form:

$$P = \alpha + \beta Q$$

Where P is the productivity growth and Q is the output growth and α and β are parameters. The equation was later popularized as Verdoorn's law. Verdoorn observed a constant long run relationship between output growth and productivity growth. Kennedy (1971) observed a

strong correlation coefficient between output growth and productivity growth for Irish manufacturing industry for the period (1946-66).

2) Capital Intensity

Capital Intensity is the capital-labour ratio of the industry. The most immediate factor affecting output per worker is the amount of machinery available. The influence of technology on labour productivity has been captured by capital intensity. It is quite evident that the worker helped by machine will produce more than the workers operating with little or no machinery. The need to employ more or less machinery is determined by a number of factors such as size of the plant, the nature and character of products, the size of the market, the state of technological advancement, the availability of capital and human resources and the possibility of substituting one by the other. The quality, size (type, efficiency, etc) of the machinery, as well as the application of modern technique in general is of equal importance.

3) Investment

Composition of capital affects productivity. Investment is taken as the change in the capital stock. Investment figures have been obtained using the formula:

$$I_t = (B_t - B_{t-1} + D_t) / R$$

Where B is the book value of fixed capital, D is the depreciation and R is an appropriate deflator for fixed capital. For R wholesale price index of machinery (base 1980-81 = 100) has been used.

4) Growth in Number of Factories

The next variable is growth in number of factories over the period. Ahluwalia's (1991) study reveals that the growth of factories in an industry is negatively related to total factor productivity growth. This probably reflects an adverse impact on productivity growth of the

phenomenon of fragmentation stemming from the policies of protection of the small scale sector. In this study an effort has been made to find the relation between labour productivity and growth in number of factories.

5) Scale Variable

Scale variable (SC) is measured as the capital stock per factory (an average of two points of time during the period). Ahluwalia's (1991) scale variable; 'capital stock per factory' is an average of the value for two points (1959-60 and 1975-76) during the period (1959-60 to 1979-80**).** Ahluwalia's study uses scale variable for finding the factors affecting productivity.

6) Total Emoluments

Wages, salaries and incentives to the workers influence the workers' ability and efficiency. The system of wage payments has an important influence on the workers' urge to produce more. The source of data for this variable is Annual Survey of Industries.

3.4) Data Sources

The basic data source for the present work is Annual Survey of Industries. This survey is being conducted every year since 1959 by National Sample Survey Organization and processed by Central Statistical Organization. Annual Survey of Industries relates to the registered sector of manufacturing. Registered factory is one which is registered under section 2 m (i) and 2 m (ii) of the factory Act 1948. The sections 2 m (i) and 2 m (ii) refer to any premises including the precincts thereof (a) wherein ten or more workers are working or were working on any day of preceding twelve months and in any part of which manufacturing process is carried on with the aid of power; or (b) wherein twenty or more workers are working or were working on any day of the preceding twelve months and in which or in any part of which a manufacturing process is carried on without the aid of power.

The National Industrial Coding (NIC) 1998 has been followed to classify factories from Annual Survey of Industries covering the period 1980-81 to 2004-05. It may be noted that till 1997-98 the classification of industries followed in the ASI was based on the national industrial classification 1987 (NIC-1987). The switch to the NIC-1998 from the year 1998-99 necessitated some matching of the NIC-1987 with NIC-1998. So for this purpose, a concordance is made between NIC 1998 and NIC 1987 using the concordance table published by the CSO. In this study the NIC-1998 as the base and accordingly data adjustment at the two digit and three digit industries level has been carried out. Some industries have to be merged (341+342+343) to build a comparable series for pre 1998 and post 1998 periods. Other industries have been adjusted using the procedure outlined in the CSO document (1998) to arrive at comparable series.

3.5) Research Methodology

The main objective of the present study is to analyse partial productivity trends in Punjab manufacturing industries for the period 1980-1992 and 1993-2005. Productivity at the aggregate level gives an overall picture. With the view to study inter industrial pattern of productivity growth, analysis is done at two digit level of disaggregation. For time series analysis secondary data have been obtained from various data bases relating to Indian manufacturing. Detailed data about registered manufacturing units have been compiled from Annual Survey of Industries (ASI). Data on suitable deflators have been obtained from index numbers of wholesale prices, (Ministry of Industry) and Indian Data Base: The Economy (Chandhok 1990). The gross measure of value added is obtained from net value added and depreciation data as given in ASI. Value added is deflated by industry specific deflators. Labour input is represented by total number of persons employed. Capital input is measured by estimates of gross fixed capital stock at replacement cost at constant prices. Perpetual Inventory method has been used for estimating capital series.

The capital stock at any year has been calculated as follow:

$$K_t = K_O + \sum_{t=1}^{T} I_t$$

Where I is investment in year t, Ko is capital stock for benchmark year. i.e.,1980-81. Investment figures have been obtained using the formula:

$$I_t = (B_t - B_{t-1} + D_t) / R_t$$

Where B is the book value of fixed capital, D is the depreciation and R is an appropriate deflator for fixed capital. The returns of labour are measured by the total of wages, salaries and benefits (total emoluments) and returns to capital are measured as value added minus the returns to labour on the assumption that returns to two factors of production exhaust the value added in the process of production.

In the study the focus is on the empirical measurement of partial productivity. Partial factor productivities measure the ratio of output to one of the inputs setting aside interdependence of the use of other inputs.

Labour productivity (V/L): it is measured as a ratio of value added to number of persons employed.

Capital productivity (V/K): it is measured as a ratio of value added to gross fixed capital. Along with partial productivity, capital intensity has also been taken for analyses.

CHAPTER- 4

LABOUR AND LABOUR PRODUCTIVITY TRENDS

4.1) Introduction

In the present chapter, productivity of capital and labour has been analysed. The study covers a period of twenty five years from 1980-81 to 2004-05. Productivity trends are calculated for the dis-aggregate manufacturing sector for two digit Industries. The growth rates of inputs (capital, labour) and output (value added) have also been analysed. To analyse the labour productivity of the manufacturing sector, analysis has been done for the pre-reform period, period-I, 1980-92 and post-reform period, period-II, 1993-05.

This chapter is divided into five parts. In section 4.1, the introduction of this chapter is given. In section 4.2, an over view of total employment in India in organized as well as unorganized sector are given. Section 4.3 focuses on the total employment in organized sector in India. In section 4.4, the findings at the level of aggregate data are discussed. The analysis of growth rate of factor inputs (labour, capital), output (value added), productivity of labour and capital and capital intensity is carried out for aggregate as well as disaggregate manufacturing sector for the entire period 1980-81 to 2004-05 as well as for the sub periods, i.e., pre-reform period and post-reform period in Sector 4.4 & 4.5. In section 4.6, the determinants of productivity in Punjab manufacturing sector at aggregate as well as disaggregate level are discussed.

4.2) Total Employment in India: An Over View

The table 4.1 depicts the total employment in Indian manufacturing sector, i.e., in the organized as well as unorganized sector. The present study focuses only on the organized sector in Punjab manufacturing.

Table: 4.1 Labour in the Organized and Unorganized Sectors of India

Sector	Female		Male		Total	
	Actual	%	Actual	%	Actual	%
Organized	3.78	4.2	22.95	10.2	26.73	8.5
Unorganized	85.99	95.8	201.41	89.8	287.4	91.5
Total	89.77	100	224.4	100	314.13	100

The table highlights that total employment in India in unorganized sector is much higher than organized sector in terms of male as well as females.

In organized sector, female labour is just 4.2% as against 95.8% in the unorganized sector, which is much higher than the organized sector. Like wise male labour percentage in unorganized sector is also higher, i.e., 89.8% compared to 10.2% in the organized sector. The total work force is just 8.5% in the organized sector and 91.5% in the unorganized sector.

4.3) Employment in the Organized Sector

In this study effort has also been made to find out the growth rate of total labour, male and female labour for the organized sector for the entire period, i.e.,1980-2005 as well as sub periods, period-I, 1980-92 (pre-reform) and period-II, i.e., 1993-05 (post-reform) to see that whether the post liberalization period has been associated with higher growth of labour.

Table: 4.2 Employment in the Organized Sector of India

Year	Total employment	Women employment	Male employment
1981	228.79	27.91	200.87
1982	234.93	28.89	206.03
1983	240.09	30.01	210.07
1984	242.15	30.51	211.63
1985	245.79	31.706	214.08
1986	250.58	32.57	218.00
1987	253.88	33.51	220.36
1988	257.12	34.45	222.66
1989	259.62	35.30	224.31
1990	263.54	37.15	226.38
1991	267.33	37.69	229.63
1992	270.56	38.96	231.59
1993	271.77	40.22	231.54
1994	273.75	41.61	232.14
1995	275.25	42.38	232.86
1996	279.41	44.14	235.26
1997	282.45	46.32	236.12
1998	281.66	47.60	234.05
1999	281.13	48.35	232.77
2000	279.6	49.20	230.39
2001	277.89	49.49	228.39
2002	272.06	50.14	221.91
2003	269.83	50.24	219.58
2004	264.427	49.68	214.74
2005	264.584	50.32	214.26

Table: 4.3 Growth rates of total, male and female employment

	Entire period 1980-2005	Period-1 1980-1992	Period-2 1993-2005
Total employment	0.69	1.39	-0.22
Women employment	2.80	3.03	1.85
Male employment	0.23	1.15	-0.68

Table 4.3 shows the growth rate of total, male and female employment in organized sector in India. The growth rate of total employment for the entire period is 0.69 per cent per annum. It has grown at a rate of 1.39 per cent per annum in the pre-reform period as against -0.22 per cent per annum in the post-reform period.

The rate of growth of women employment has grown at a rate of 3.03 per cent per annum in the pre-reform period, as against 1.85 per cent per annum in the post-reform period. The growth rate of women employment is 2.80 per cent per annum for the entire period.

An analysis of male employment highlights that the growth has been -0.68 per cent per annum in period-II, as against 1.15 per cent per annum in period-I. The growth rate of male employment is higher in the pre-reform era. The rate of growth for entire period is 0.23 per cent per annum.

An over all view depict that growth rates for both for male and female labour have declined in the post-reform era.

4.4. Aggregative Analysis

Table 4.4 shows the growth rate of output and inputs in Punjab manufacturing at aggregate level for the time period 1980-81 to 2004-05. A comparison has been made between the pre-reform period and post-reform period to see whether there is an increase in growth in manufacturing sector in Punjab.

Table: 4.4 Growth Rates of Value added, Capital, Employment and Productivity Trends in Punjab Manufacturing

	1980-81-2004-05	1980-81-1991-92	1992-1993-2004-05
Value added	2.80	4.95	0.92
Capital	4.71	5.19	0.92
Employment	7.15	9.64	1.62
Labour Productivity	3.75	6.65	0.002
Capital Productivity	1.84	-0.23	-0.002
Capital Intensity	2.09	0.46	0.23

The analysis depicts that growth rate of 2.80 per cent per annum in output (value added) in manufacturing sector during 1980-81 to 2004-05 is associated with a 4.71 per cent per annum capital growth rate and 7.15 per cent per annum employment growth rate in Punjab manufacturing sector. Comparing the pre-reform period, i.e., 1980-92 with 1993-05, the post-reform period, the analysis reveals that there is a sharp decline in growth rate of value added from 4.95 per cent per annum in period I to 0.92 per cent per annum in period II.

Labour productivity for the entire period is 3.75 per cent per annum while capital productivity is 1.84 per cent per annum. Capital intensity for the whole period increased at an annual rate of 2.09 per cent per annum. Analysis of sub-periods depict that labour productivity increases at a higher rate, i.e., at a 6.65 per cent per annum in the pre-reform period as against 0.002 per cent per annum in the post-reform period. Growth rate of capital productivity is negative in both pre and post-reform periods. Growth rate of capital intensity of sub-periods depict that it increases at a higher rate, i.e., at a 0.46 per cent per annum in the pre-reform period as against 0.23 per cent per annum in the post-reform period.

4.5) Sector wise Analysis

The table 4.5 shows the growth rates of value added in Punjab manufacturing at the disaggregate level for the time period 1980-81 to 2004-05. A comparison has been made

between the pre-reform period and the post-reform period to see whether there is an increase in manufacturing sector in Punjab in the post liberalization period.

Table: 4.5 Growth Rates of Value Added

Value added				
Industry code	**Industry Name**	**Entire period 1980-2005**	**Period-1 1980-1992**	**Period-2 1993-2005**
15	Manufacture of Food Products	9.80	11.40	6.20
16	Manufacture of Beverages	8.50	14.50	3.20
17	Manufacture Textile	9.80	11.40	6.20
18	Wearing Apparel; Dressing and Dyeing of Fur	13.90	11.20	5.80
19	Tanning and Dressing of Leather, Luggage, Handbags Saddlery, Harness and Footwear	10.20	12.20	-0.01
20	Wood and Products of wood and Cork, Except Furniture; Articles of Straw and Plating Materials	12.40	6.50	18.40
21	Paper and Paper Products	6.80	6.50	2.70
22	Publishing, Printing and Reproduction of Recorded Media	3.50	7.60	5.00
23	Coke, Refined Petroleum Products and Nuclear Fuel	-1.00	-0.10	-0.01
24	Chemicals and Chemical Products	10.90	8.70	5.70
25	Rubber and Plastic Products	11.10	9.80	3.50
26	Other Non-Metallic Mineral Products	6.80	10.00	1.00
27	Basic Metals	6.70	7.20	3.00
28	Fabricated Metal Products, Except Machinery and Equipments	9.20	8.70	2.60
29	Machinery and Equipment N.E.C	5.10	-2.00	6.80
30	Manufacture of Office, Accounting and Computing Machinery	3.60	-2.00	-3.00
31	Electrical Machinery and Apparatus N.E.C	8.30	0.20	15.90
32	Radio, Television and Communication Equipment and Apparatus	6.60	7.20	4.00
33	Medical, Precision and Optical Instruments, Watches and Clocks	10.30	3.40	7.00
34	Motor Vehicles	7.00	6.10	3.90
35	Other Transport Equipment	8.10	11.40	4.20
36	Manufacture of Furniture	14.30	4.20	17.00

The growth rates of value added has grown at a rate of 11.40 per cent per annum in the pre-reform period as against 6.20 per cent per annum in the post-reform period in the

manufacture of Food products # 15 sector. The rate of growth of value added is 9.80 per cent per annum for the entire period.

The rate of growth of value added in manufacture of Beverages sector # 16 is 8.50 per cent per annum for the entire period and the rate of growth is also higher in the first period of analysis. Growth of value added has been 3.20 per cent per annum in post-reform era as against 14.50 per cent per annum in the pre-reform era. The nineties onwards period shows a decline in value added.

An analysis of manufacture textile # 17 highlights that the growth of value added has been 6.20 per cent per annum in period II as against 11.40 per cent per annum in period I. The growth rate of value added is higher in the pre-reform era. The rate of growth for entire period is 9.80 per cent per annum.

An analysis of wearing apparel; dressing and dyeing of fur sector # 18 is indicative of the fact that there has been a decline in the value added from 11.20 per cent in period-I to 5.80 per cent per annum in period-II. Value added grows at a rate of 13.90 per cent per annum for the entire period.

The growth rate of value added has become negative, and is -0.01 per cent per annum in the post-reform period while it was 12.20 per cent per annum in the pre-reform period. The growth rate of entire period is 10.20 per cent per annum in the tanning and dressing of leather, luggage, handbags saddlery, harness and footwear # 19.

In the wood and products of wood and cork, except furniture; articles of straw and plating material sector # 20 growth rate of value added has been 18.40 per cent per annum in post-reform period. The growth rate for entire period has been 12.40 per cent per annum. The growth rate of wood and products of wood and cork, except furniture; articles of straw and plating material sector shows an acceleration from 6.50 per cent per annum in period-I to 18.40 per cent per annum in the post liberalization phase.

An analysis of paper and paper products # 21 highlights that the growth rate of value added is shrinking overtime. The growth rate was 6.50 per cent per annum in pre-reform period, as against 2.70 per cent per annum in post-reform period. The growth rate is 6.80 per cent per annum for the entire period.

Value added of publishing, printing and reproduction of recorded media # 22 has grown at a rate of slow pace of 3.50 per cent per annum for the entire period. The growth rate of value added shows a decline in the post-reform period as compared to pre-reform period, as can be seen from table.

Coke, refined petroleum products and nuclear fuel #23 records a negative value added of rate of growth for the entire period as well as for both the periods. It shows some improvement in the post-reform era. Value added has -1.00 per cent per annum for the entire period. It has -0.10 per cent per annum in the pre-reform period and -0.01 per cent per annum in the post-reform period.

Value added in chemicals and chemical products # 24 records a rate of growth of 10.90 per cent per annum for the entire period. The rate of growth of value added is higher in the pre-reform period, i.e., 8.70 as compared to post-reform period i.e., 5.70.

Rubber and plastic products # 25 has increased at an annual rate of 11.10 per cent per annum in the value added growth. On splitting the period, it is found that the rate of growth of value added has declined from 9.80 per cent per annum in the pre-reform period to 3.50 per cent per annum in the post-reform period.

Other non-metallic mineral products # 26 shows a rate of growth of 6.80 per cent per annum in value added for the entire period. The rate of growth of value added is 10.00 per cent per annum in the pre-reform period as against 1.00 per cent per annum in the post-reform period.

An analysis of basic metals # 27 sector depicts that there has been a rapid growth in value added, i.e., at a rate of 6.70 per cent per annum for the entire period, and that there has been

deceleration in the rate of growth of value added in the post-reform period. The growth rate is 7.20 per cent per annum in the pre-reform period as against 3.00 per cent per annum in the post-reform period.

The growth rate of value added of fabricated metal products, except machinery and equipments # 28 depicts an annual growth rate of 9.20 per cent per annum for the entire period. There is a sharp decline in the growth rate in the post-reform period, i.e., 2.60 per cent per annum. The growth rate of value added is higher, i.e., 8.70 per cent per annum in the pre-reform period.

An analysis of machinery and equipment N.E.C # 29 shows that value added growth rate for the entire period is 5.10 per cent per annum. The growth rate is 6.80 per cent per annum in the post-reform period which shows an increase from the negative growth of -2.00 per cent per annum in the pre-reform period.

Value added has grown at a rate of 3.60 per cent per annum for the entire period for manufacture of office, accounting and computing machinery # 30. The rate of growth is negative in both the periods, i.e., period I and period II. The growth is -2.00 per cent per annum in the pre-reform period and -3.00 per cent per annum in the post-reform period.

In the electrical machinery and apparatus N.E.C sector # 31 value added has grown at the rate of 8.30 per cent per annum for the entire period. The rate of growth of 15.90 per cent per annum in the nineties onwards era is much higher than 0.20 per cent per annum in pre-reform phase.

Value added in radio, television and communication equipment and apparatus # 32 group depicts an annual growth rate of 6.60 per cent per annum for the entire period. An analysis of sub periods shows that the rate of growth of value added is higher 7.20 per cent per annum during the pre-reform period. The growth rate is 4.00 per cent per annum in the post-reform period which is lower than pre-reform period.

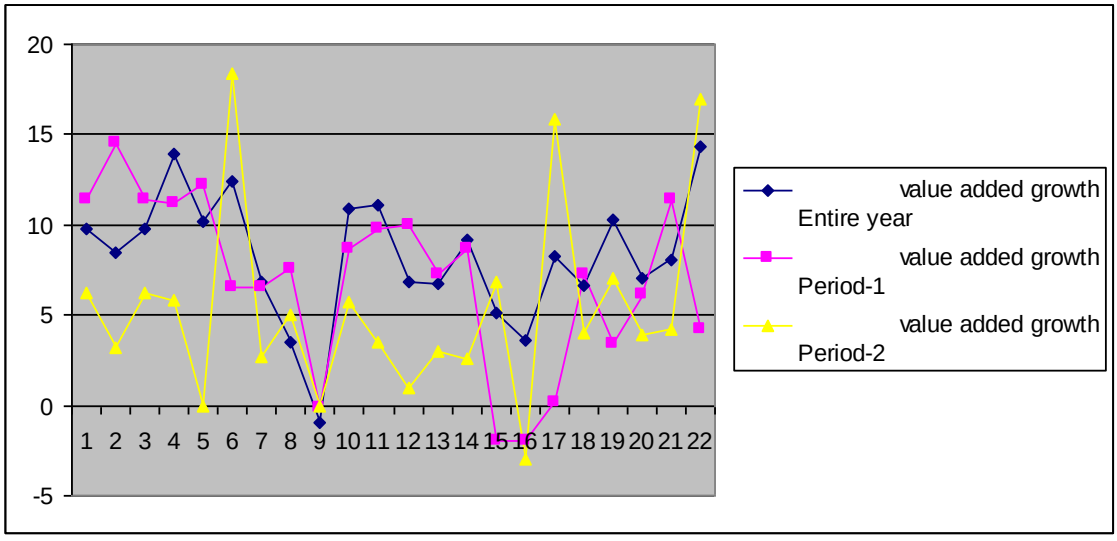
The rate of growth of value added is 10.30 per cent per annum in medical, precision and optical instruments, watches and clocks # 33. The growth rate shows acceleration from 3.40 per cent per annum in pre-reform period to 7.00 per cent per annum in post-reform period.

The growth rates of value added of motor vehicles # 34 sector is 7.00 per cent per annum for the entire period. The growth rate is 6.10 per cent per annum in the pre-reform period and is higher as compared to post-reform period growth of 3.90 per cent per annum.

The growth rate of value added for other transport equipment # 35 industry is 8.10 per cent per annum for the entire period. The growth rate of value added in the pre-reform period is 11.40 per cent per annum as compared to 4.20 per cent per annum in post-reform period.

Value added in manufacture of furniture sector # 36 grows at a rate of 14.30 per cent per annum for the entire period. The growth rate is 4.20 per cent per annum in the pre-reform period and 17.00 per cent per annum in post-reform period**.**

Figure: 4.1 Growth Rates of Value Added



Overall analysis (as shown in figure 4.1) depicts that highest growth rate has been recorded by manufacture of furniture # 36. This is followed by wood and products of wood and cork, except furniture; articles of straw and plating materials # 20.

The low performer is reported by coke, refined petroleum products and nuclear fuel # 23 which depicts a negative growth for all periods. This is followed by manufacture of office, accounting and computing machinery # 30.

Table: 4.6 Growth Rates of Labour

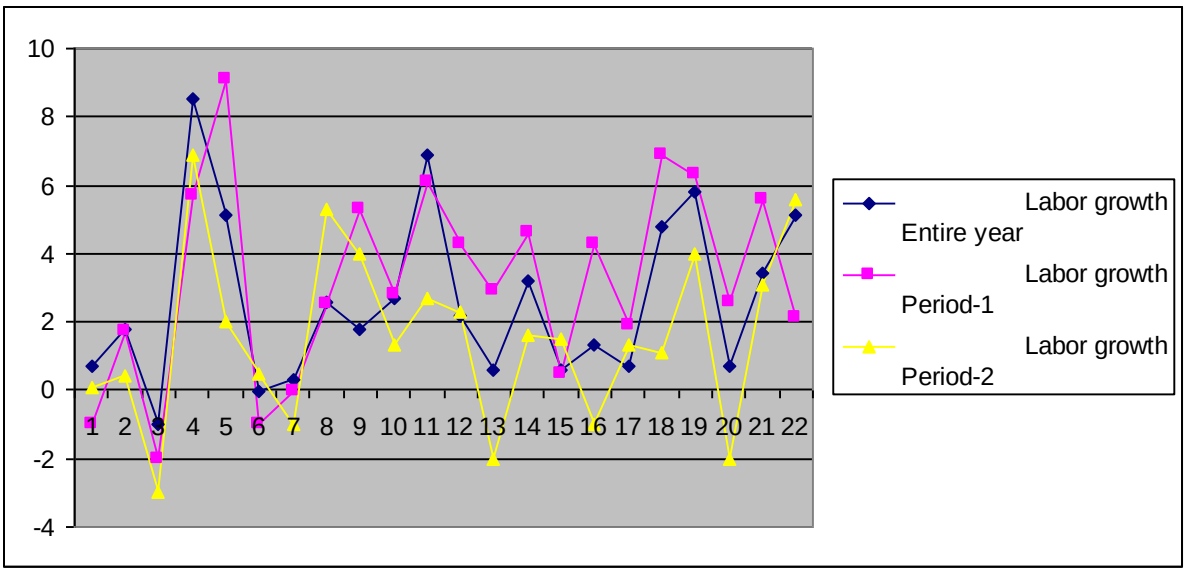
Labour Growth				
Industry code	**Industry Name**	**Entire period 1980-05**	**Period-1 1980-92**	**Period-2 1993-05**
15	Manufacture of Food Products	0.70	-1.00	0.10
16	Manufacture of Beverages	1.80	1.70	0.40
17	Manufacture Textile	-1.00	-2.00	-3.00
18	Wearing Apparel; Dressing and Dyeing of Fur	8.50	5.70	6.90
19	Tanning and Dressing of Leather, Luggage, Handbags Saddlery, Harness and Footwear	5.10	9.10	2.00
20	Wood and Products of wood and Cork, Except Furniture; Articles of Straw and Plating Materials	-0.01	-1.00	0.50
21	Paper and Paper Products	0.30	-0.01	-1.00
22	Publishing, Printing and Reproduction of Recorded Media	2.60	2.50	5.30
23	Coke, Refined Petroleum Products and Nuclear Fuel	1.80	5.30	4.00
24	Chemicals and Chemical Products	2.70	2.80	1.30
25	Rubber and Plastic Products	6.90	6.10	2.70
26	Other Non-Metallic Mineral Products	2.20	4.30	2.30
27	Basic Metals	0.60	2.90	-2.00
28	Fabricated Metal Products, Except Machinery and Equipments	3.20	4.60	1.60
29	Machinery and Equipment N.E.C	0.60	0.50	1.50
30	Manufacture of Office, Accounting and Computing Machinery	1.30	4.30	-1.00
31	Electrical Machinery and Apparatus N.E.C	0.70	1.90	1.30
32	Radio, Television and Communication Equipment and Apparatus	4.80	6.90	1.10
33	Medical, Precision and Optical Instruments, Watches and Clocks	5.80	6.30	4.00
34	Motor Vehicles	0.70	2.60	-2.00
35	Other Transport Equipment	3.40	5.60	3.10
36	Manufacture of Furniture	5.10	2.10	5.60

Above table (4.6) presents growth rates of labour in all two-digit industries of Punjab manufacturing sector during 1980-81 to 2004-05 and also for sub periods, period-I 1980-92 and period-II 1993-2005. An analysis of this is indicative of the fact that there has been a varied growth in the labour in industries for the entire period. Higher rate of growth of labour, i.e., 8.50 per cent per annum has been reported for wearing apparel; dressing and dyeing of fur # 18. This is followed by rubber and plastic products # 25 recording growth of 6.90 per cent per annum, tanning and dressing of leather, luggage, handbags saddlery, harness and footwear # 33 having growth rate of 5.80 per cent per annum.

The lowest performance is reported by: manufacture textile # 17 and wood and products of wood and cork, except furniture; articles of straw and plating materials # 20, which depicts a negative trend, i.e., -1.00 per cent per annum and -0.01 per cent per annum respectively for the entire period.

Sector wise analysis depicts that in terms of labour the growth rate for manufacturing sector is higher for sixteen industrial groups in the pre-reform phase during 1980-92 while only six groups depict higher growth in the post-reform phase.

Figure: 4.2 Growth Rates of Labour



Overall analysis as shown in above Figure: 4.2 depicts that there has been a deceleration in the growth rate of labour in the post-reform period. There are five industries reporting negative rate of growth in this period.

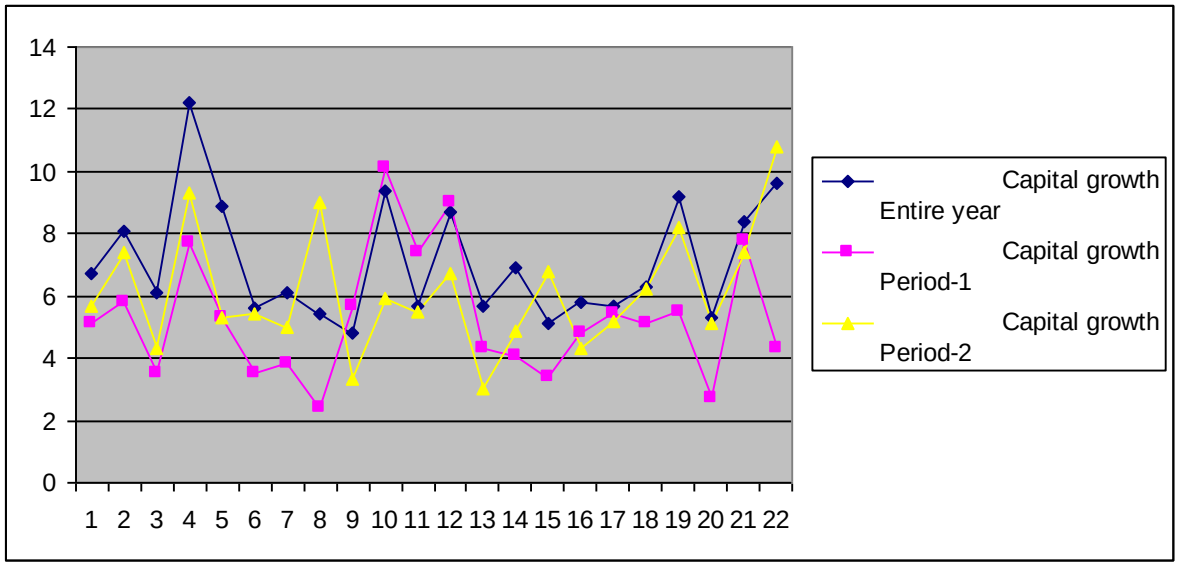
Table: 4.7 Growth Rates of Capital

Capital Growth				
Industry code	**Industry Name**	**Entire Period 1980-05**	**Period-1 1980-92**	**Period-2 1993-05**
15	Manufacture of Food Products	6.70	5.10	5.70
16	Manufacture of Beverages	8.10	5.80	7.40
17	Manufacture Textile	6.10	3.50	4.30
18	Wearing Apparel; Dressing and Dyeing of Fur	12.20	7.70	9.30
19	Tanning and Dressing of Leather, Luggage, Handbags Saddlery, Harness and Footwear	8.90	5.30	5.30
20	Wood and Products of wood and Cork, Except Furniture; Articles of Straw and Plating Materials	5.60	3.50	5.40
21	Paper and Paper Products	6.10	3.80	5.00
22	Publishing, Printing and Reproduction of Recorded Media	5.40	2.40	9.00
23	Coke, Refined Petroleum Products and Nuclear Fuel	4.80	5.70	3.30
24	Chemicals and Chemical Products	9.40	10.10	5.90
25	Rubber and Plastic Products	5.70	7.40	5.50
26	Other Non-Metallic Mineral Products	8.70	9.00	6.70
27	Basic Metals	5.70	4.30	3.00
28	Fabricated Metal Products, Except Machinery and Equipments	6.90	4.10	4.90
29	Machinery and Equipment N.E.C	5.10	3.40	6.80
30	Manufacture of Office, Accounting and Computing Machinery	5.80	4.80	4.30
31	Electrical Machinery and Apparatus N.E.C	5.70	5.40	5.20
32	Radio, Television and Communication Equipment and Apparatus	6.30	5.10	6.20
33	Medical, Precision and Optical Instruments, Watches and Clocks	9.20	5.50	8.20
34	Motor Vehicles	5.30	2.70	5.10
35	Other Transport Equipment	8.40	7.80	7.40
36	Manufacture of Furniture	9.60	4.30	10.80

Table 4.7 presents wide variation in growth rates of capital. The rate of growth ranged between 2.40 per cent per annum to 12.20 per cent per annum. This table presents growth rates of capital in all two-digit industries of Punjab manufacturing sector during 1980-81 to 2004-05. An analysis of this is indicative of the fact that there has been a rapid growth in the capital for the entire period. Highest rate of growth of capital, i.e., 12.20 per cent per annum has been reported for wearing apparel; dressing and dyeing of Fur # 18. This is followed by manufacture of furniture # 36 recording growth of 9.60 per cent per annum and chemical and chemical products # 24 having growth rate of 9.40 per cent per annum.

The lowest performance is reported by: Coke, Refined Petroleum Products and Nuclear fuel # 23 and Machinery and Equipment N.E.C # 29, which depicts a very low performance, i.e., 4.80 per cent per annum and 5.10 per cent per annum respectively for the entire period.

Figure: 4.3 Growth Rates of Capital



Sector wise analysis depicts (figure 4.3) that in terms of capital the growth rate for manufacturing sector is higher for thirteen industrial groups in the post-reform phase during 1993-05. Eight groups depict higher growth in the pre-reform phase and one sector, i.e., tanning and dressing of leather, luggage, handbags saddlery, harness and footwear # 19 shows similar performance (5.30 per cent per annum) in both pre and post-reform periods.

The highest growth rate of capital in post-reform era is recorded for manufacture of furniture # 36 is 10.80 per cent per annum, followed by wearing apparel; dressing and dyeing of fur # 18 and publishing, printing and reproduction of recorded media # 22. The lowest performance in post-reform era has been recorded by basic metals # 27, coke, refined petroleum products and nuclear fuel # 23, i.e., 3.00 per cent per annum and 3.30 per cent per annum. Two industries manufacture textile #17 and manufacture of office, accounting and computing machinery # 30 having similar capital growth in the post-reform period.

After analysis growth rate of value added and inputs (labour and capital) analysis has been done for labour productivity, capital productivity and capital-labour ratio to have a clearer picture of Punjab manufacturing.

Table (4.8) presents an analysis of productivity of labour in all two-digit industries of Punjab manufacturing sector during 1980-81 to 2004-05 is indicative of the fact that there has been a rapid growth of productivity of labour for most of industries for the entire period. Higher labour productivity i.e., 12.50 per cent per annum has been reported for wood and products of wood and cork, except furniture; articles of straw and plating materials # 20. This is followed by manufacture textile # 17 recording growth of 11.40 per cent per annum. Two industries manufacture of food products # 15 and manufacture of furniture # 36 shows similar growth pattern of labour productivity, i.e., 9.10 per cent per annum for the entire period.

The lowest performance in labour productivity is reported by: coke, refined petroleum products and nuclear fuel # 23 and manufacture of office, accounting and computing machinery # 30, which indicates negative growth of -3.00 per cent per annum for the entire period during 1980 to 2005 for both the sectors.

Sector wise analysis highlights that labour productivity for manufacturing sector is higher for ten industrial groups in the post-reform phase during 1980-92 while twelve groups depict higher growth in the pre-reform phase.

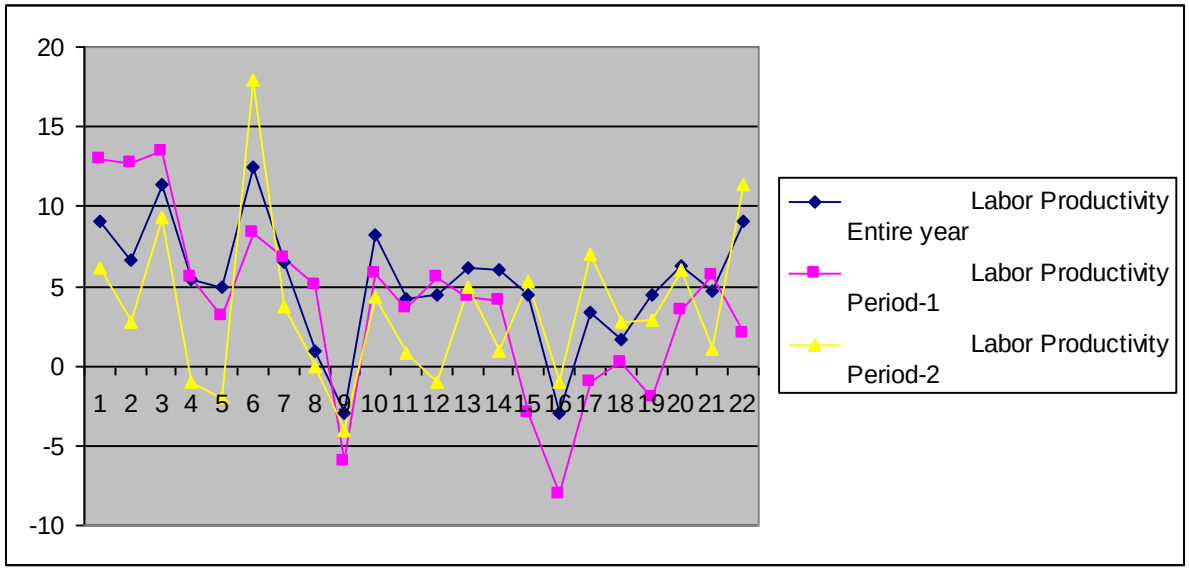
Table: 4.8 Labour Productivity

Labour Productivity				
Industry code	**Industry Name**	**Entire year 1980-05**	**Period-1 1980-92**	**Period-2 1993-05**
15	Manufacture of Food Products	9.10	13.00	6.10
16	Manufacture of Beverages	6.70	12.70	2.70
17	Manufacture Textile	11.40	13.40	9.30
18	Wearing Apparel; Dressing and Dyeing of Fur	5.40	5.50	-1.00
19	Tanning and Dressing of Leather, Luggage, Handbags Saddlery, Harness and Footwear	5.00	3.10	-2.00
20	Wood and Products of wood and Cork, Except Furniture; Articles of Straw and Plating Materials	12.50	8.30	17.90
21	Paper and Paper Products	6.50	6.80	3.70
22	Publishing, Printing and Reproduction of Recorded Media	0.90	5.10	-0.01
23	Coke, Refined Petroleum Products and Nuclear Fuel	-3.00	-6.00	-4.00
24	Chemicals and Chemical Products	8.20	5.80	4.30
25	Rubber and Plastic Products	4.20	3.60	0.80
26	Other Non-Metallic Mineral Products	4.50	5.60	-1.00
27	Basic Metals	6.10	4.30	5.00
28	Fabricated Metal Products, Except Machinery and Equipments	6.00	4.10	0.90
29	Machinery and Equipment N.E.C	4.50	-3.00	5.30
30	Manufacture of Office, Accounting and Computing Machinery	-3.00	-8.00	-1.00
31	Electrical Machinery and Apparatus N.E.C	3.40	-1.00	7.00
32	Radio, Television and Communication Equipment and Apparatus	1.70	0.20	2.80
33	Medical, Precision and Optical Instruments, Watches and Clocks	4.50	-2.00	2.90
34	Motor Vehicles	6.30	3.50	6.00
35	Other Transport Equipment	4.70	5.70	1.00
36	Manufacture of Furniture	9.10	2.00	11.40

The highest growth rate (17.90 per cent per annum) of labour productivity has been recorded by wood and products of wood and cork except furniture; articles of straw and plating materials # 20, followed by manufacture of furniture # 36 in post-reform period.

The low performers is in post-reform era are: wearing apparel; dressing and dyeing of fur # 18, tanning and dressing of leather, luggage, handbags saddlery, harness and footwear # 19, publishing, printing and reproduction of recorded media # 22, coke, refined petroleum products and nuclear fuel # 23, other non-metallic mineral products #26 and manufacture of office, accounting and computing machinery # 30. All these industries have a negative growth for the post-reform period.

Figure: 4.4 Labour Productivity



The results indicate (as shown in Figure 4.4) poor performance of the manufacturing industries in labour productivity from in the post-reform era. This calls for an action to take steps to enhance productivity of labour.

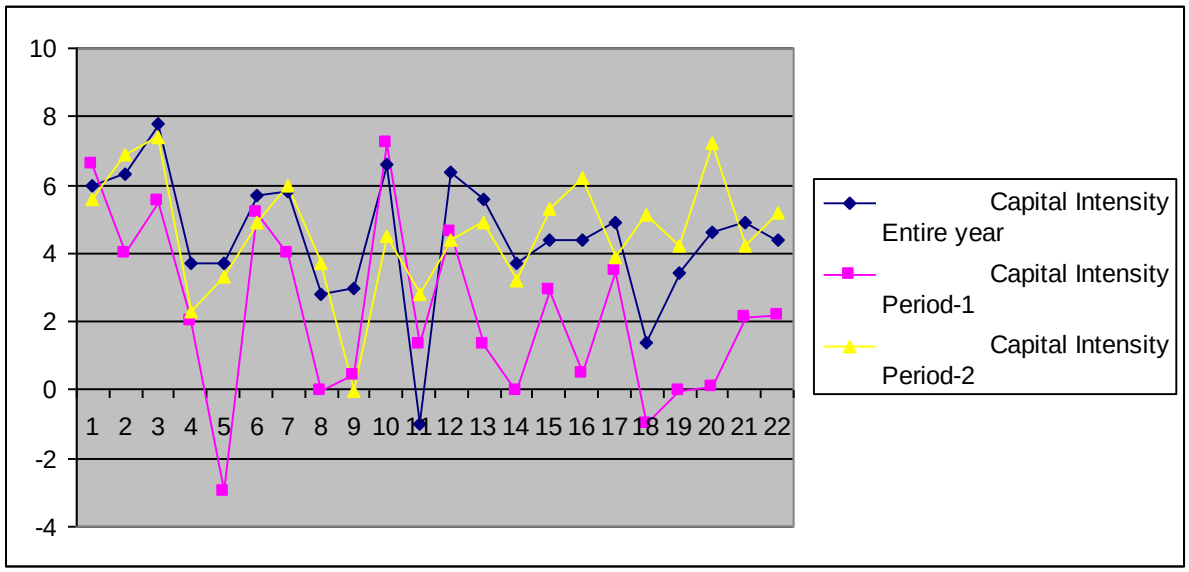
Table: 4.9 Capital Intensity

Capital Intensity				
Industry code	**Industry Name**	**Entire year 1980-05**	**Period-1 1980-92**	**Period-2 1993-05**
15	Manufacture of Food Products	6.00	6.60	5.60
16	Manufacture of Beverages	6.30	4.00	6.90
17	Manufacture Textile	7.80	5.50	7.40
18	Wearing Apparel; Dressing and Dyeing of Fur	3.70	2.00	2.30
19	Tanning and Dressing of Leather, Luggage, Handbags Saddlery, Harness and Footwear	3.70	-3.00	3.30
20	Wood and Products of wood and Cork, Except Furniture; Articles of Straw and Plating Materials	5.70	5.20	4.90
21	Paper and Paper Products	5.80	4.00	6.00
22	Publishing, Printing and Reproduction of Recorded Media	2.80	-0.01	3.70
23	Coke, Refined Petroleum Products and Nuclear Fuel	3.00	0.40	-0.01
24	Chemicals and Chemical Products	6.60	7.20	4.50
25	Rubber and Plastic Products	-1.00	1.30	2.80
26	Other Non-Metallic Mineral Products	6.40	4.60	4.40
27	Basic Metals	5.60	1.30	4.90
28	Fabricated Metal Products, Except Machinery and Equipments	3.70	-0.01	3.20
29	Machinery and Equipment N.E.C	4.40	2.90	5.30
30	Manufacture of Office, Accounting and Computing Machinery	4.40	0.50	6.20
31	Electrical Machinery and Apparatus N.E.C	4.90	3.50	3.90
32	Radio, Television and Communication Equipment and Apparatus	1.40	-1.00	5.10
33	Medical, Precision and Optical Instruments, Watches and Clocks	3.40	-0.01	4.20
34	Motor Vehicles	4.60	0.10	7.20
35	Other Transport Equipment	4.90	2.10	4.20
36	Manufacture of Furniture	4.40	2.20	5.20

The results highlight on improvement in capital intensity in most of the sectors in the post-reform era.

Table 4.9 presents capital intensity in all two-digit industries of Punjab manufacturing sector during 1980-81 to 2004-05. An analysis highlights there has been a rapid change in the capital intensity for the entire period. Higher capital intensity, i.e., 7.80 per cent per annum has been reported for manufacture textile # 18. This is followed by Chemicals and Chemical Products # 24 recording productivity of 6.60 per cent per annum and other non-metallic mineral products # 26 having productivity rate is 6.40 per cent per annum. The lowest performance is reported by: Rubber and Plastic Products # 25, i.e., -1.00 per cent per annum.

Figure: 4.5 Capital Intensity



The above Figure 4.5 shows sector wise analysis. Capital intensity for manufacturing sector is higher for just five industrial groups in the pre-reform phase during 1980-92 while seventeen groups depict higher growth in the post-reform phase. Highest capital intensity in post-reform era has been recorded for manufacture textile # 17 this is followed by motor vehicles # 34 and manufacture of beverages # 16. Low performer industry in post-reform era has been recorded by coke, refined petroleum products and nuclear fuel # 23. This is followed by wearing apparel; dressing and dyeing of fur # 18 and rubber and plastic products # 25.

Table: 4.10 Capital Productivity

Capital Productivity				
Industry code	**Industry Name**	**Entire year 1980-05**	**Period-1 1980-92**	**Period-2 1993-05**
15	Manufacture of Food Products	3.00	6.30	0.40
16	Manufacture of Beverages	0.40	8.70	-4.00
17	Manufacture Textile	3.60	7.90	1.80
18	Wearing Apparel; Dressing and Dyeing of Fur	1.60	3.40	-3.00
19	Tanning and Dressing of Leather, Luggage, Handbags Saddlery, Harness and Footwear	1.20	6.90	-5.00
20	Wood and Products of wood and Cork, Except Furniture; Articles of Straw and Plating Materials	6.70	3.00	12.90
21	Paper and Paper Products	0.70	2.70	-2.00
22	Publishing, Printing and Reproduction of Recorded Media	-1.00	5.20	-4.00
23	Coke, Refined Petroleum Products and Nuclear Fuel	-6.00	-6.00	-3.00
24	Chemicals and Chemical Products	1.50	-1.00	-0.01
25	Rubber and Plastic Products	5.40	23.00	-2.00
26	Other Non-Metallic Mineral Products	-1.00	1.00	-5.00
27	Basic Metals	1.00	2.90	-0.01
28	Fabricated Metal Products, Except Machinery and Equipments	2.20	4.60	-2.00
29	Machinery and Equipment N.E.C	0.01	-6.00	-0.01
30	Manufacture of Office, Accounting and Computing Machinery	-2.00	-6.00	-7.00
31	Electrical Machinery and Apparatus N.E.C	-1.00	-5.00	-3.00
32	Radio, Television and Communication Equipment and Apparatus	0.30	2.00	-2.00
33	Medical, Precision and Optical Instruments, Watches and Clocks	1.10	-2.00	-1.00
34	Motor Vehicles	1.70	3.40	-1.00
35	Other Transport Equipment	-0.001	3.60	-3.00
36	Manufacture of Furniture	4.60	-0.01	6.20

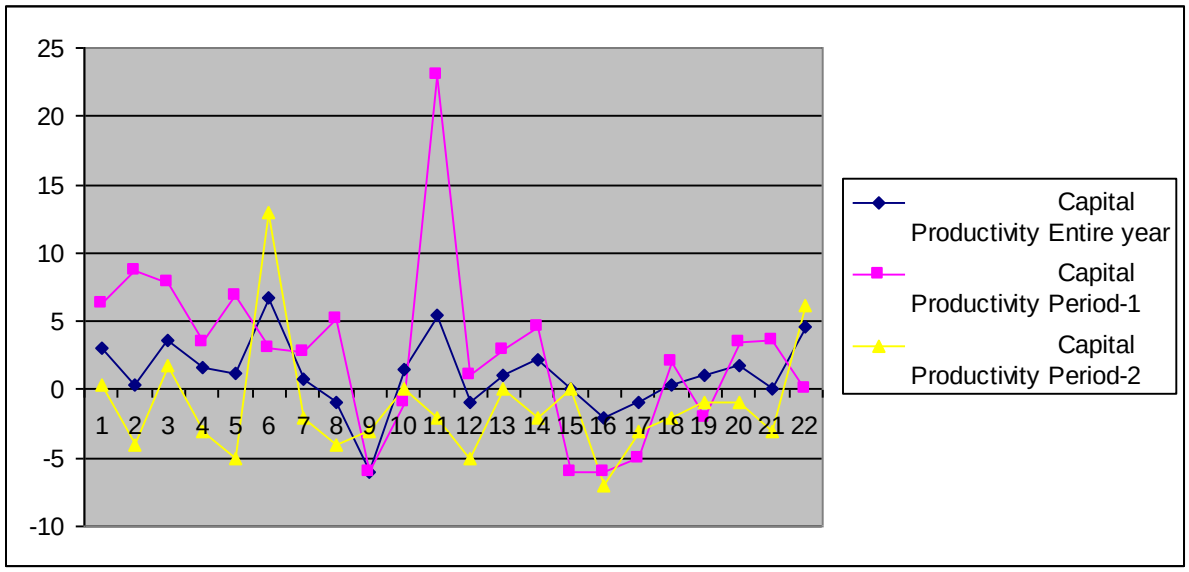
Table 4.10 presents the productivity of capital in all two-digit industries of Punjab manufacturing sector during 1980-81 to 2004-05.

Higher capital productivity, i.e., 6.70 per cent per annum has been reported for wood and products of wood and cork, except furniture; articles of straw and plating materials # 20. This is followed by rubber and plastic products # 25 recording productivity of 5.40 per cent per annum and manufacture of furniture # 36, i.e., 4.60 per cent per annum for the entire period.

The lowest performance is recorded by coke, refined petroleum products and nuclear fuel # 23, i.e., -6.00 per cent per annum for the entire period. Publishing, printing and reproduction of recorded media # 22, other non-metallic mineral products # 26 and electrical machinery and apparatus N.E.C # 31 are depicting negative trend of -1.00 per cent per annum.

Sector wise analysis depicts that in terms of capital productivity for manufacturing sector is higher for only seven industrial groups in the post-reform phase during 1993-05 while fifteen groups depict lower growth in this phase.

Figure: 4.6 Capital Productivity



The highest productivity (as shown in diagram 4.6) of capital is recorded for wood and products of wood and cork, except furniture; articles of straw and plating materials # 20 which shows 12.90 per cent per annum for the post-reform period.

The lowest performance has been recorded by manufacture of office, accounting and computing machinery # 30 industry which depicts -7.00 per cent per annum in the post-reform period.

Sector wise analysis highlights the poor performance in the post-reform era as there has been deceleration in case of sixteen industries.

This calls for an urgent need to assess the situation and take steps to improve the productivity performance of Punjab manufacturing.

Table: 4.11 Growth Rates of Value Added, Capital and Labour

Industry code	Industry Name	Value Added			Labour			Capital		
		Entire Period	Period-I	Period-II	Entire year	Period-I	Period-II	Entire Period	Period-I	Period-II
15	Food Products	9.80	11.40	6.20	0.70	-1.00	0.10	6.70	5.10	5.70
16	Beverages	8.50	14.50	3.20	1.80	1.70	0.40	8.10	5.80	7.40
17	Textile	9.80	11.40	6.20	-1.00	-2.00	-3.00	6.10	3.50	4.30
18	Wearing apparel; Dressing and Dyeing of Fur	13.90	11.20	5.80	8.50	5.70	6.90	12.20	7.70	9.30
19	Tanning and Dressing of Leather	10.20	12.20	-0.01	5.10	9.10	2.00	8.90	5.30	5.30
20	Wood and Products of wood and Cork	12.40	6.50	18.40	-0.01	-1.00	0.50	5.60	3.50	5.40
21	Paper and Paper Products	6.80	6.50	2.70	0.30	-0.01	-1.00	6.10	3.80	5.00
22	Publishing, Printing and Reproduction of Rec. Media	3.50	7.60	5.00	2.60	2.50	5.30	5.40	2.40	9.00
23	Coke, Refined Petroleum Products and Nuclear Fuel	-1.00	-0.10	-0.01	1.80	5.30	4.00	4.80	5.70	3.30
24	Chemicals and Chemical Products	10.90	8.70	5.70	2.70	2.80	1.30	9.40	10.10	5.90
25	Rubber and Plastic Products	11.10	9.80	3.50	6.90	6.10	2.70	5.70	7.40	5.50
26	Other Non-Metallic Mineral Products	6.80	10.00	1.00	2.20	4.30	2.30	8.70	9.00	6.70
27	Basic Metals	6.70	7.20	3.00	0.60	2.90	-2.00	5.70	4.30	3.00
28	Fabricated Metal Products, Except Machinery & Equip.	9.20	8.70	2.60	3.20	4.60	1.60	6.90	4.10	4.90
29	Machinery and Equipment N.E.C	5.10	-2.00	6.80	0.60	0.50	1.50	5.10	3.40	6.80
30	Office, Accounting and Computing Machinery	3.60	-2.00	-3.00	1.30	4.30	-1.00	5.80	4.80	4.30
31	Electrical Machinery and Apparatus N.E.C	8.30	0.20	15.90	0.70	1.90	1.30	5.70	5.40	5.20
32	Radio, Television and Communication Equipment and Apparatus	6.60	7.20	4.00	4.80	6.90	1.10	6.30	5.10	6.20
33	Medical, Precision and Optical Instruments, Watches and Clocks	10.30	3.40	7.00	5.80	6.30	4.00	9.20	5.50	8.20
34	Motor Vehicles	7.00	6.10	3.90	0.70	2.60	-2.00	5.30	2.70	5.10
35	Other Transport Equipment	8.10	11.40	4.20	3.40	5.60	3.10	8.40	7.80	7.40
36	Manufacture of Furniture	14.30	4.20	17.00	5.10	2.10	5.60	9.60	4.30	10.80

The table 4.11 shows the growth rates of value added, labour and capital of Punjab manufacturing at the disaggregate level for the time period 1980-81 to 2004-05 and also for two sub-periods, i.e., period-I (1980-92) and period-II (1993-2005). A comparison has been

made between pre-reform period and post-reform period to see whether there is an improvement in performance of manufacturing sector in Punjab.

The growth rate of value added has grown for sixteen industries for the period-I, i.e., 1980-92 and for six industries for the period- II during 1993-2005.

The highest performance is reported by manufacture of furniture # 36. This is followed by wood and products of wood and cork, except furniture: articles of straw and plating material # 20 recording a growth rate of 12.40 per cent per annum.

The lowest performance is recorded by coke, refined petroleum products and nuclear fuel # 23, which having negative values for all the periods. This is followed by manufacture of office, accounting and computing machinery # 30.

The growth rate of labour has grown for sixteen industries for the period-I during 1980-92 and for six industries for the period- II, i.e., 1993-2005.

The highest performance is reported by wearing apparel; dressing and dyeing of fur # 18. This is followed by rubber and plastic products # 25 and medical, precision and optical instruments, watches and clocks # 33.

The lowest performance of labour growth is recorded by manufacture textile # 17, which having negative values for all periods. This is followed by wood and products of wood and cork, except furniture; articles of straw and plating materials # 20 and paper and paper products # 21.

The growth rate of capital has grown for nine industries for the period-I, i.e., 1980-92 and for thirteen industries for the period-II during 1993-2005.

The highest performance for capital growth is reported by wearing apparel; dressing and dyeing of fur # 18 and this is followed by manufacture of furniture # 36 and chemicals and chemical products # 24 for all the periods.

The low performers are coke, refined petroleum products and nuclear fuel # 23 and basic metals # 27.

Two industries namely wearing apparel; dressing and dyeing of fur # 18 and manufacture of furniture # 36 record a higher growth in value added as well as in inputs, i.e., labour and capital.

The overall lower performance is recorded by coke, refined petroleum products and nuclear fuel # 23. This is followed by manufacture textile # 17 and manufacture of office, accounting and computing machinery # 30.

Table: 4.12 Productivity of Labour, Capital and Capital Intensity

Ind. code	Industry Name	Labour Productivity			Capital Intensity			Capital Productivity		
		Entire year	Period-I	Period-II	Entire year	Period-I	Period-II	Entire year	Period-I	Period-II
15	Food Products	9.10	13.00	6.10	6.00	6.60	5.60	3.00	6.30	0.40
16	Beverages	6.70	12.70	2.70	6.30	4.00	6.90	0.40	8.70	-4.00
17	Textile	11.40	13.40	9.30	7.80	5.50	7.40	3.60	7.90	1.80
18	Wearing apparel; Dressing and Dyeing of Fur	5.40	5.50	-1.00	3.70	2.00	2.30	1.60	3.40	-3.00
19	Tanning and Dressing of Leather, Luggage, Handbags Saddlery, Harness and Footwear	5.00	3.10	-2.00	3.70	-3.00	3.30	1.20	6.90	-5.00
20	Wood and Products of wood and Cork	12.50	8.30	17.90	5.70	5.20	4.90	6.70	3.00	12.90
21	Paper and Paper Products	6.50	6.80	3.70	5.80	4.00	6.00	0.70	2.70	-2.00
22	Publishing, Printing and Reproduction of Rec. Media	0.90	5.10	-0.01	2.80	-0.01	3.70	-1.00	5.20	-4.00
23	Coke, Refined Petroleum Products and Nuclear Fuel	-3.00	-6.00	-4.00	3.00	0.40	-0.01	-6.00	-6.00	-3.00
24	Chemicals and Chemical Products	8.20	5.80	4.30	6.60	7.20	4.50	1.50	-1.00	-0.01
25	Rubber and Plastic Products	4.20	3.60	0.80	-1.00	1.30	2.80	5.40	23.00	-2.00
26	Other Non-Metallic Mineral Products	4.50	5.60	-1.00	6.40	4.60	4.40	-1.00	1.00	-5.00
27	Basic Metals	6.10	4.30	5.00	5.60	1.30	4.90	1.00	2.90	-0.01
28	Fab. Metal Products, Except Machinery and Equipments	6.00	4.10	0.90	3.70	-0.01	3.20	2.20	4.60	-2.00
29	Machinery and Equipment N.E.C	4.50	-3.00	5.30	4.40	2.90	5.30	0.01	-6.00	-0.01
30	Manufacture of Office, Accounting and Computing Machinery	-3.00	-8.00	-1.00	4.40	0.50	6.20	-2.00	-6.00	-7.00
31	Electrical Machinery and Apparatus N.E.C	3.40	-1.00	7.00	4.90	3.50	3.90	-1.00	-5.00	-3.00
32	Radio, Television and Communication Equipment and Apparatus	1.70	0.20	2.80	1.40	-1.00	5.10	0.30	2.00	-2.00
33	Medical, Precision and Optical Instruments, Watches and Clocks	4.50	-2.00	2.90	3.40	-0.01	4.20	1.10	-2.00	-1.00
34	Motor Vehicles	6.30	3.50	6.00	4.60	0.10	7.20	1.70	3.40	-1.00
35	Other Transport Equipment	4.70	5.70	1.00	4.90	2.10	4.20	-0.01	3.60	-3.00
36	Manufacture of Furniture	9.10	2.00	11.40	4.40	2.20	5.20	4.60	-0.01	6.20

The table (4.12) above shows the growth rate of value added, labour and capital in Punjab manufacturing at the disaggregate level for the time period 1980-81 to 2004-05 and also for two sub-periods, i.e., period-I (1980-92) and period-II (1993-2005). A comparison has been made between pre-reform period and post-reform period, i.e., 1980-81 to 2004-05 to see whether there is an improvement in performance of manufacturing sector in Punjab.

The productivity of labour has grown for twelve industries for the period-I, i.e., 1980-92 and ten industries for the period- II during 1993-2005.

The highest performance is reported by manufacture textile # 17. This is followed by wood and products of wood and cork, except furniture; articles of straw and plating materials # 20 and manufacture of furniture # 36.

The lowest performance is recorded by coke, refined petroleum products and nuclear fuel # 23, which having negative values for all the periods. This is followed by manufacture of office, accounting and computing machinery # 30.

The capital intensity has grown for just five industries for the period-I during 1980-92 and seventeen industries for the period- II, i.e., 1993-2005.

The highest performance is reported by manufacture textile # 17. This is followed by chemicals and chemical products # 24.

The lowest performance of capital intensity is recorded by tanning and dressing of leather, luggage, handbags saddlery, harness and footwear # 19, which having negative values for period-I, i.e., 1980-92. This is followed by rubber and plastic products # 25.

The productivity of capital has grown for fifteen industries for the period-I, i.e., 1980-92 and seven for the period-II during 1993-2005.

The highest performance for capital productivity is reported by rubber and plastic products # 25 and this is followed by manufacture of furniture # 36 and wood and products of wood and cork, except furniture; articles of straw and plating materials # 20.

The lowest performance is recorded by coke, refined petroleum products and nuclear fuel # 23 and manufacture of office, accounting and computing machinery # 30, which shows a very low productivity of capital.

Three industries namely manufacture textile # 17, manufacture of furniture # 36 and wood and products of wood and cork, except furniture; articles of straw and plating materials # 20 record a higher growth in productivity of labour, capital and capital intensity.

The overall lower performance is recorded by coke, refined petroleum products and nuclear fuel # 23. This is followed by manufacture of office, accounting and computing machinery # 30 and tanning and dressing of leather, luggage, handbags saddlery, harness and footwear # 19.

4.6) Determinants of Labour Productivity in Punjab Manufacturing

In this section an attempt has been made to trace the factors influencing labour productivity in Punjab manufacturing at aggregate and two digit level industries. Ordinary least square and step wise regression models have been used for analyzing the factor affecting productivity. The time period for the analysis has been 1980-81 to 2004-05. The purpose of the study is to find out the relationship between growth in labour productivity and growth in variables like rate of growth of output, capital-labour ratio, rate of growth of investment, rate of growth of factories, scale variables and total emoluments. The dependent variable is labour productivity growth.

4.6.1) Aggregative Analysis

Entire Manufacturing

Regression results of the entire manufacturing sector in Punjab are depicted by the equation:

$Y = 0.47a + 0.006x_1^{**} - 1.007x_2^{**} - 0.007x_3 - 0.006x_4 + 0.008x_5 + 0.006x_6^{**}$

t = (2.244) (3.378) (-5.122) (-0.795) (-0.066) (1.936) (5.831)

$R^2 = 0.94$

Ordinary least square regression model underscores the fact that the labour productivity is positively related to output growth, scale variable and total emoluments. Capital intensity, investment and growth in number of factories show a negative relationship with labour productivity. Regression coefficient for output, capital-labour ratio and total emoluments are statistically significant at 1 per cent level. The explanatory variations of the model are 94 per cent.

Step wise regression selects output, capital intensity, scale variable and total emoluments as important determinants of productivity. All determinants are statistically significant at 1 per cent level.

$Y = 0.46a + 0.006x_1^{**} - 1.047x_2^{**} + 0.008x_5^{**} + 0.006x_6^{**}$

t = (11.405) (3.846) (-5.836) (3.331) (7.630)

$R^2 = 0.94$

The explanatory power of the model is 94 per cent.

4.6.2) Sector wise Analysis

15) Manufacture of Food Products

Regression results of the food products sector in Punjab are depicted by the equation:

$Y = 0.37a + 0.008x_1 + 0.415x_2 + 0.008x_3 + 0.005x_4 - 0.009x_5 - 0.006x_6^{**}$

t = (-0.470) (0.778) (1.193) (0.360) (0.906) (-1.172) (-0.354)

$R^2 = 0.65$

Labour productivity has a positive association with output growth, capital intensity, investment and growth in number of factories. Labour productivity is negatively related to scale variable and total emoluments. Regression coefficient for total emoluments is statistically significant at 1 percent level. The model explains 65 per cent of the variations in labour productivity.

Stepwise regression analysis highlights the fact that total emolument is the most important determinant of labour productivity. Regression coefficient for total emoluments is statistically significant at 1 per cent level. The explanatory variable variation of the model is 60 per cent.

$Y = 0.006x_6^{**}$

t = (5.725)

$R^2 = 0.60$

16) Manufacture of Beverages

The regression equation of this sector is:

$y = 4.96a + 0.009x_1 + 0.005x_2 + 0.01x_3 – 0.002x_4 – 0.007x_5 + 0.006x_6^{**}$

t = (105.26) (0.39) (0.66) (0.23) (-1.07) (-0.80) (15.37)

$R^2 = 0.98$

Labour productivity is positively related with output growth, capital-labour ratio, investment and total emoluments. It is negatively related with growth in number of factories and scale variable. Regression coefficient for total emolument is statistically significant at 1 per cent level. Out of the total variation in labour productivity 98 per cent is explained by the model.

Stepwise regression analysis has selected capital-labour ratio to be a significant at 1 per cent level and important determinant of labour productivity.

$Y = 0.07a + 0.925x_2^{**} + 0.007x_6^{**}$
t = (-0.71) (4.81) (16.01)
$R^2 = 0.92$

The model explains 92 per cent variations in labour productivity.

17) Manufacture textile

$Y = 0.02a - 0.008x_1 + 0.302x_2^{*} - 0.009x_3 - 0.005x_4 - 0.001x_5 + 0.006x_6$
t = (-0.051) (-0.579) (2.473) (-0.026) (-0.827) (-0.646) (1.123)
$R^2 = 0.98$

Ordinary least square regression model underscores the fact that the labour productivity is positively related to capital-labour ratio and total emoluments. Output growth, investment, growth in number of factories and scale variables shows a negative relationship with labour productivity. Regression coefficient for capital-labour ratio is significant at 5 per cent level. The explanatory variations of the model are 98 per cent.

$Y = 0.15a + 0.229x_2^{**}$
t = (-6.032) (29.937)
$R^2 = 0.97$

Stepwise regression analysis has selected capital-labour ratio to be a significant at 1 per cent level and important determinant of labour productivity. The explanatory variations of the model are 97 per cent.

18) Wearing Apparel; Dressing and Dyeing of Fur

Regression results of the wearing apparel; dressing and dyeing of fur sector in Punjab are depicted by the equation:

$Y = 0.56a + 0.007x_1 + 0.791x_2^{**} + 0.007x_3 + 0.0001x_4 - 0.011x_5^{**} + 0.006x_6^{**}$

t = (-2.426) (1.537) (3.629) (0.528) (1.807) (-4.155) (5.121)

$R^2 = 0.92$

The labour productivity is positively related to output growth, capital-labour ratio, investment, growth in number of factories and total emoluments. It is negatively associated with scale variable. Regression coefficient for capital intensity, scale variable and total emoluments are statistically significant at 1 per cent level. Explanatory power of labour productivity variables comes to be 92 per cent.

Stepwise regression selects output growth and total emoluments as important determinants of productivity. These regression coefficients are statistically significant at 1 per cent level.

$Y = 0.315a + 0.006x_1^{**} + 0.005x_6^{**}$

t = (9.04) (5.119) (-3.962)

$R^2 = 0.81$

The model explains 81 per cent variations in labour productivity.

19) Tanning and Dressing of Leather, Luggage, Handbags Saddlery, Harness and Footwear

The regression equation of tanning and dressing of leather, luggage, handbags saddlery, harness and footwear is:

$Y = 0.18a + 0.007x_1 + 0.05x_2 – 0.007x_3 + 0.005x_4 – 0.004x_5^{*} + 0.006x_6$

t = (1.16) (0.72) (1.85) (-0.23) (0.36) (-2.39) (0.14)

$R^2 = 0.46$

The model depicts a positive relationship of labour productivity with output growth, capital intensity, growth in number of factories and total emoluments. Investment and scale variable are negatively related to labour productivity. The regression coefficient for scale variable is significant at 5 per cent level. The value of R^2 is only 46 per cent.

Stepwise regression has picked up growth in number of factories as the determinant of labour productivity. It is statistically significant at 5 per cent level. The explanatory power of the model is very low.

$Y = 0.06a + 0.005x_4^{*}$

t = (-1.01) (2.46)

$R^2 = 0.22$

Coefficient of determination turns out to be 22 per cent.

20) Wood and Products of wood and Cork, Except Furniture; Articles of Straw and Plating Materials

$Y = 0.014a – 0.007x_1^{*} + 0.076x_2^{**} + 0.007x_3 – 0.006x_4 – 0.003x_5 + 0.006x_6^{**}$

t = (0.204) (-2.118) (2.908) (0.966) (-0.540) (-1.688) (3.873)

$R^2 = 0.91$

Ordinary least square regression model highlights that the labour productivity is positively related to capital-labour ratio, investment and total emoluments. Output growth, growth in

number of factories and scale variables shows a negative relationship with labour productivity. Regression coefficient for capital-labour ratio and total emolument are significant at 1 per cent and output growth is significant at 5 per cent level. The explanatory variations of the model are 91 per cent.

$Y = 0.003a + 0.006x_6^{**}$

t = (0.412) (9.224)

$R^2 = 0.80$

Stepwise regression has picked up total emoluments as the determinant of labour productivity. Regression coefficient for total emoluments is significant at 1 per cent level. The explanatory variation of the model is 80 per cent.

21) Paper and Paper Products

The empirical results for paper and paper products are:

$Y = 1.63a + 0.006x_1 – 0.105x_2 + 0.007x_3 + 0.002x_4 + 0.002x_5 – 0.005x_6$

t = (-0.77) (0.25) (-0.22) (0.97) (1.27) (0.23) (-1.13)

$R^2 = 0.53$

Output growth, investment, growth in number of factories and scale variable are positively related with labour productivity. Capital intensity and total emoluments are negatively related with labour productivity. Out of the total variation in labour productivity 53 per cent is explained by the model.

Stepwise regression analysis has selected growth in number of factories to be significant determinant of labour productivity.

$Y = 0.83a + 0.001x_4$

t = (-1.69) (3.83)

$R^2 = 0.41$

The model explains 41 per cent variations in labour productivity.

22) Publishing, Printing and Reproduction of Recorded Media

Regression results of the publishing, printing and reproduction of recorded media sector in Punjab are depicted by the equation:

$Y = 3.40a + 0.006x_1 – 0.103x_2 + 0.006x_3 – 0.001x_4^* + 0.001x_5 – 0.006x_6$

t = (3.80) (1.15) (-0.54) (1.13) (-2.38) (0.105) (-0.09)

$R^2 = 0.41$

The results of regression depict a positive relationship of labour productivity with output growth, investment and scale variable. It is negatively related with capital-labour ratio, growth in number of factories and total emoluments. Regression coefficient for growth in number of factories is statistically significant at 5 per cent level. Explanatory power of labour productivity variables comes to be 41 per cent.

Step wise regression analysis failed to select the dominant independent variable.

23) Coke, Refined Petroleum Products and Nuclear Fuel

The regression equation for this sector is:

$Y = 1.99a – 0.008x_1 – 0.018x_2 – 0.008x_3 + 0.0001x_4 + 0.001x_5 + 0.006x_6$

t = (5.57) (-0.102) (-1.64) (-0.29) (1.39) (1.34) (0.62)

$R^2 = 0.60$

In the coke, refined petroleum products and nuclear fuel sector, labour productivity is positively associated with growth in number of factories, scale variable and total emoluments. It is negatively associated with output growth, capital intensity and investment. The model explains 60 per cent of the total variations in labour productivity.

Stepwise regression has selected growth in number of factories as the determinant of productivity. The regression coefficient for growth in number of factories is statistically significant at 1 per cent level. The explanatory variation of the model is 47 per cent.

$Y = 2.40a + 0.0001x_4^{**}$

t = (11.39) (-4.31)

$R^2 = 0.47$

24) Chemicals and chemical products

Regression equation for chemicals and chemical products sector is:

$Y = 0.10a + 0.007x_1^{**} + 0.01x_2 + 0.009x_3 – 0.005x_4^{*} + 0.0001x_5^{*} + 0.007x_6$

t = (4.25) (7.85) (1.85) (1.86) (-2.56) (-2.08) (1.61)

$R^2 = 0.99$

Labour productivity is positively related to all the independent variables except with that of growth in number of factories. Regression coefficient for output growth is statistically significant at 1 per cent level and growth in number of factory and scale variable are significant at 5 per cent level. The value of R^2 is 99 per cent.

Stepwise regression analysis highlights the fact that output growth is the most important determinant of labour productivity. The coefficient of regression for output growth is statistically significant at 1 per cent level.

$Y = 0.04a + 0.007x_1^{**}$

t = (9.52) (42.51)

$R^2 = 0.98$

The value for step wise regression R^2 is 98 per cent.

25) Rubber and plastic products

Regression results for the rubber and plastic products sector are as follow:

$Y = 8.13a - 0.006x_1 - 0.573x_2 + 0.007x_3 + 0.004x_4 + 0.01x_5 - 0.005x_6$

t = (0.99) (-0.49) (-0.99) (0.55) (1.18) (1.181) (-0.22)

$R^2 = 0.19$

Labour productivity is directly related with investment, growth in number of factories and scale variables. It is inversely related with output, capital-labour ratio and total emoluments. The explanatory variation of the model is just 19 per cent.

Step wise regression analysis failed to select the dominant independent variable.

26) Other non-metallic mineral products

The empirical results for this sector are:

$Y = 0.08a + 0.007x_1^{**} + 0.018x_2^{**} - 0.008x_3^{**} - 0.005x_4^{**} + 0.0001x_5^{**} + 0.007x_6^{**}$

t = (9.79) (45.21) (19.98) (-3.61) (-6.67) (-13.81) (4.31)

$R^2 = 0.99$

The model explains 99 per cent of total variations in labour productivity. Labour productivity is positively related to output, capital intensity, scale variable and total emoluments. It is negatively related to investment and growth in number of factories. Regression coefficients for all variables are statistically significant at 1 per cent level. Out of the total variation in labour productivity 99 per cent is explained by the model.

Stepwise regression has also related with all independent variables as above.

$Y = 0.08a + 0.007x_1^{**} - 0.005x_4^{**} + 0.018x_2^{**} + 0.001x_5^{**} + 0.007x_6^{**} - 0.008x_3^{**}$

t = (9.79) (45.21) (-6.67) (19.98) (-13.81) (4.31) (-3.61)

$R^2 = 0.99$

Coefficient of determination turns out to be 99 per cent.

27) Basic metals

Regression equation for basic metal product sector is:

$Y = 0.20a + 0.007x_1^{**} + 0.011x_2^{**} - 0.009x_3 - 0.005x_4^{**} + 0.0001x_5^{**} - 0.009x_6$

t = (11.84) (233.56) (58.71) (-1.83) (-10.49) (-20.13) (-0.12)

$R^2 = 0.99$

Ordinary least square regression model underscores the fact that the labour productivity is positively related to output growth, capital-labour ratio and scale variable. Investment, growth in number of factories and total emoluments shows a negative relationship with labour productivity. Regression coefficient for output growth, capital-labour ratio, growth in number of factories and scale variable are significant at 1 per cent level. The explanatory power of the model is 99 per cent.

$Y = 0.19a + 0.007x_1^{**} + 0.0001x_5^{**} + 0.001x_2^{**} - 0.005x_4^{**}$

t = (11.43) (236.22) (59.65) (-25.65) (-9.95)

$R^2 = 0.99$

Output growth, capital-labour ratio and scale variable shows a positively relationship with labour productivity. Growth in number of factories shows a negative relationship with labour productivity. Explanatory power of labour productivity variables comes to be 99 per cent. All these variables are statistically significant at 1 per cent level.

28) Fabricated Metal Products, Except Machinery and Equipments

Regression results of the fabricated metal products, except machinery and equipments sector in Punjab are depicted by the equation:

$Y = 0.3a + 0.007x_1^{**} + 0.014x_2^{**} - 0.009x_3 - 0.006x_4 + 0.0001x_5^{**} - 0.007x_6$

t = (1.54) (11.22) (19.48) (-0.32) (-1.09) (-4.62) (-0.92)

$R^2 = 0.99$

The regression results indicate that labour productivity is positively associated with output growth, capital intensity and scale variable and negatively related with investment, growth in number of factories and total emoluments. The regression coefficient for output growth, capital intensity and scale variable are statistically significant at 1 per cent level. The explained variation of the model is 99 per cent.

Stepwise regression model depicts output growth, capital intensity and scale variable to be the most important and significant determinants at 1 per cent level. Coefficient of determination turns out to be 99 per cent.

$Y = 0.01a + 0.007x_1^{**} + 0.014x_2^{**} + 0.0001x_5^{**}$

t = (4.16) (20.94) (20.77) (-8.89)

$R^2 = 0.99$

29) Machinery and Equipment N.E.C

Regression equation for this sector is:

$Y = 1.22a + 0.006x_1 + 0.095x_2 + 0.007x_3 + 0.005x_4 - 0.002x_5 + 0.007x_6$

t = (2.63) (1.91) (1.59) (1.20) (0.32) (-1.22) (0.13)

$R^2 = 0.84$

Labour productivity is directly related to all the independent variables except scale variable. The value of R^2 is 84 per cent.

Stepwise regression analysis highlights the fact that output growth and growth in number of factories are the most important determinants of labour productivity. These determinants are statistically significant at 1 per cent level.

$Y = 0.58a + 0.006x_1^{**} + 0.0001x_4^{**}$

t = (3.004) (3.87) (3.50)

$R^2 = 0.77$

Explanatory power of labour productivity variables comes to be 77 per cent.

30) Manufacture of Office, Accounting and Computing Machinery

Regression equation for manufacture of office, accounting and computing machinery sector is:

$Y = 6.104a + 0.006x_1 - 0.848x_2 + 0.006x_3 - 0.001x_4 + 0.02x_5 - 0.005x_6$

t = (0.95) (0.26) (-0.62) (0.41) (-0.46) (0.49) (-0.57)

$R^2 = 0.17$

Ordinary least square regression model underscores the fact that the labour productivity is positively related to output growth, investment and scale variable. Capital-labour ratio, growth in number of factories and total emoluments shows a negative relationship with labour productivity. The model explains only 17 per cent of variations in labour productivity.

Stepwise regression analysis failed to select the dominant independent variable.

31) Electrical Machinery and Apparatus N.E.C

Regression results for the electrical machinery and apparatus N.E.C sectors are as follow

$Y = 1.52a - 2.49x_1 + 0.04x_2 + 0.007x_3 - 0.005x_4 + 0.0001x_5 + 0.006x_6$

t = (2.94) (-0.21) (0.61) (0.77) (-0.37) (0.20) (1.18)

$R^2 = 0.66$

The regression results indicate that labour productivity is positively associated with capital intensity, investment, scale variable and total emoluments and negatively related with output growth and growth in number of factories. Out of total variations in labour productivity 66 per cent is explained by the model.

$Y = 1.53a + 0.002x_5^{**}$

t = (16.94) (5.10)

$R^2 = 0.55$

Stepwise regression model depicts scale variable to be the most important and significant determinant at 1 per cent level of labour productivity. Coefficient of determination turns out to be 55 per cent.

32) Radio, Television and Communication Equipment and Apparatus

Regression equation of this sector is:

$Y = 2.40a - 0.007x_1 + 0.004x_2 - 0.007x_3 + 0.005x_4 + 0.0001x_5 + 0.006x_6$

t = (28.83) (-0.30) (0.06) (-1.72) (0.29) (-0.32) (0.79)

$R^2 = 0.24$

The model explains just 24 per cent of total variations in labour productivity. Labour productivity is positively related to capital-labour ratio, growth in number of factories, scale variable and total emoluments. It is negatively related to output growth, and investment.

Step wise regression analysis failed to select the dominant independent variable.

33) Medical, Precision and Optical Instruments, Watches and Clocks

Regression results of the medical, precision and optical instruments, watches and clocks sector is Punjab are depicted by the equation:

$Y = 0.08a + 0.007x_1^{**} + 0.015x_2^{**} + 0.008x_3 - 0.005x_4^{**} + 0.0001x_5^{**} + 0.007x_6$

t = (3.65) (11.03) (8.17) (0.44) (-2.91) (-3.86) (0.78)

$R^2 = 0.96$

Labour productivity is directly related to all the independent variables except growth in number of factories. Regression coefficient for output growth, capital intensity, growth in number of factories and scale variable are statistically significant at 1 per cent level. The value of R^2 is 96 per cent.

$Y = 0.08a + 0.007x_1^{**} + 0.015x_2^{**} + 0.0001x_5^{**} - 0.005x_4^{**}$

t = (3.69) (12.22) (8.45) (-5.99) (-2.92)

$R^2 = 0.98$

Step wise regression reveals that labour productivity is positively related to output growth, capital intensity and scale variable. It is negatively related to growth in number of factories. The regression coefficients for all independent variables are statistically significant at 1 per cent level. The explanatory power of the model is 98 per cent.

34) Motor vehicles

The empirical results for the motor vehicles sector are:

$Y = 1.37a + 0.006x_1 - 0.10x_2 + 0.007x_3 + 0.002x_4 + 0.003x_5 - 0.005x_6$

t = (-0.78) (0.49) (-0.19) (0.49) (1.08) (0.64) (-1.08)

$R^2 = 0.52$

The model explains 52 per cent of total variation in labour productivity. Labour productivity is positively related to output growth, investment, growth in number of factories and scale variable. Labour productivity is negatively related to capital intensity and total emoluments.

An analysis of stepwise regression depicts that capital intensity is important determinant and statistically significant at 1 per cent level of labour productivity. The value of R^2 is 0.40.

$Y = 0.20a + 0.22x_2^{**}$
$t = (-0.50) \quad (3.80)$
$R^2 = 0.40$

35) Other Transport Equipment

The regression equation for this sector is:

$Y = 0.40a - 2.45x_1 + 0.001x_2 - 1.25x_3 + 0.0001x_4^{*} + 0.001x_5 + 0.008x_6$
$t = \quad (1.02) \quad (-0.50) \quad (0.02) \quad (-1.29) \quad (2.55) \quad (1.31) \quad (0.02)$
$R^2 = 0.78$

Ordinary least square regression model underscores the fact that the labour productivity is positively related to capital-labour ratio, growth in number of factories, scale variable and total emoluments. Output growth and investment shows a negative relationship with labour productivity. Regression coefficient for growth in number of factories is significant at 5 per cent level. The model explains 78 per cent of variations in labour productivity.

Step wise regression analysis failed to select the dominant independent variable.

36) Manufacture of Furniture

The empirical results for manufacture of furniture sector are:

$Y = 0.05a + 0.007x_1^{**} + 0.033x_2^{*} - 0.008x_3 - 0.005x_4 - 0.001x_5^{**} + 0.006x_6$

t = (2.09) (6.81) (2.36) (-0.22) (-2.006) (-3.46) (1.71)

$R^2 = 0.96$

Labour productivity is positively related with output growth, capital intensity and total emoluments and is negatively related with investment, growth in number of factories and scale variable. Regression coefficient for capital intensity is statistically significant at 5 per cent level and output growth and scale variable are significant at 1 per cent level. Coefficient of determination turns to be 96 per cent.

Stepwise regression has selected output growth and scale variable as important determinants of productivity. All these determinants are statistically significant at 1 per cent level. The value of R^2 is 95 per cent.

$Y = 0.04a + 0.007x_1^{**} + 0.0001x_5^{**}$

t = (8.20) (9.91) (-3.18)

$R^2 = 0.95$

CHAPTER-V

CONCLUSIONS

The basic purpose of this study has been to investigate the structural changes in labour growth and labour productivity in manufacturing sector of Punjab for the period 1980-81 to 2004 -05 and for sub periods, i.e., period-I (1980-92) and period-II (1993-05). This chapter discusses the conclusions, policy implications, limitations of the study and finally gives recommendations for future work.

The present study uses secondary data from ASI. The study analyses the trends in labour productivity, capital productivity and capital intensity at two digit level for Punjab manufacturing. An attempt has been made to examine the growth rates of output (value added) and inputs (labour and capital). The analysis has been done for the time period 1980-81 to 2004-05. To compare the pre-reform period with post-reform period, the entire period has been divided into two sub-periods, period-I, 1980-81 to 1991-92 and period-II, 1992-93 to 2004-05. An attempt has also been made to isolate the determinants of labour productivity growth in Punjab manufacturing.

5.1) Major Findings of the study

For Punjab manufacturing the aggregative analysis depicts an overall long term growth of 2.80 per cent per annum in value added during 1980-81 to 2004-05. This has been associated with a low growth of capital (0.3 per cent per annum) and employment (0.5 per cent per annum). Labour productivity for the entire period shows an increase of 3.75 per cent per annum, while capital productivity increases at a rate of 1.84 per cent per annum. Capital intensity for the entire period increases at a rate of 2.09 per cent per annum.

The results of disaggregative analysis depict that value added has been the highest for the manufacture of furniture # 36. Growth rates of value added have been higher for sixteen

industrial groups in the pre-reform phase. Growth rates of labour are also higher for sixteen industrial groups in the pre-reform phase. Growth rates of capital depict acceleration in thirteen industrial groups in the post-reform phase. Thus the post-1991 period has been associated with lower growth in value added and labour and higher growth in capital.

Sector wise analysis depicts that in terms of value added, the growth rate for manufacturing sector has been higher for sixteen industrial groups in the period-I, i.e., 1980-92 while six groups depict higher growth in the period- II, i.e., 1993-2005. The highest growth rate of value added is recorded for manufacture of furniture # 36 reporting a growth rate of 14.30 per cent per annum. This is followed by wood and products of wood and cork, except furniture: articles of straw and plating material # 20 recording a growth rate of 12.40 per cent per annum. The lowest performance is reported by coke, refined petroleum products and nuclear fuel # 23, which is having negative values for the entire as well as both the periods. This is followed by manufacture of office, accounting and computing machinery # 30.

The highest growth rate of capital is recorded for wearing apparel; dressing and dyeing of fur # 18, followed by manufacture of furniture # 36 and chemicals and chemical products # 24 for all the periods. The low performers are coke, refined petroleum products and nuclear fuel # 23 and basic metals # 27. Thirteen sectors depict higher growth of capital in the post-reform period.

Rate of growth of labour has grown for sixteen industries for the period-I during 1980-92 and for six industries for the post-reform era, i.e., 1993-2005. The highest performance is reported by wearing apparel; dressing and dyeing of fur # 18. This is followed by rubber and plastic products # 25 and medical, precision and optical instruments, watches and clocks # 33. The lowest performance of labour growth is recorded by manufacture textile # 17, which having negative values for all periods. This is followed by wood and products of wood and cork, except furniture; articles of straw and plating materials # 20 and paper and paper products # 21.

The manufacturing sector depicts a slow down of labour growth in the post-reform period for six out of twenty two sectors. The picture is slightly better for the labour productivity for the entire period as ten sectors depict growth rate of more than 6.00 per cent per annum but even in this case labour productivity is higher in twelve sectors in the first period of analysis. Labour productivity shows improvement in ten sectors in the post-reform phase.

A look at capital productivity trends depict that for six manufacturing industries, capital productivity is negative for the entire period of analysis and there are only three industrial groups depict growth rate more than four percent. These are: wood and products of wood and cork, except furniture; articles of straw and plating materials # 20, rubber and plastic products # 25 and manufacture of furniture # 36. The picture is not very bright on the capital productivity front also. Trends in capital productivity for the two sub-periods depict that capital productivity is higher for most of the sectors in the first period of analysis, i.e., the pre-reform era and in the post-reform era only seven out of twenty two sectors depict an improvement in capital productivity. So the trends depict a lower growth of both capital productivity and labour productivity for most of the industrial groups in the post-reform period.

Capital intensity for manufacturing sector is higher for just five industrial groups in the pre-reform phase during 1980-92 while seventeen groups depict higher growth in the post-reform phase. Highest capital intensity in post-reform era has been recorded for manufacture textile # 17. This is followed by motor vehicles # 34 and manufacture of beverages # 16. Low performer industry in post-reform era has been recorded by coke, refined petroleum products and nuclear fuel # 23. This is followed by wearing apparel; dressing and dyeing of fur # 18 and rubber and plastic products # 25.

The regression results on the basis of aggregative analysis of the determinants of productivity for Punjab manufacturing depict that coefficients for output, scale variable and total emoluments are positive related with labour productivity. Output, capital intensity and total emoluments are statistically significant at 1 per cent level. The explanatory variations of the model are 94 per cent.

The regression results on the basis of disaggregative analysis of the determinants of productivity for Punjab manufacturing depict that coefficients for output growth variable are positive and statistically significant in all the industries except six industries.

A significant and positive relationship has also been observed between capital intensity and labour productivity in sixteen industries. The regression coefficients of total emoluments are positive for most of the industries. Motivation is basic to all human behavior and it leads to improvement in productivity. Productivity depends on financial incentives provided to workers and other employees. This includes the method of paying wages and salaries, rewards and other incentive plans. The regression coefficients of total emoluments are significant for five industries. The regression coefficients of investment are positively related with labour productivity for thirteen industries. In nine sectors investment coefficients are negatively related to labour productivity. Growth in number of factories enters in many industries with a negative sign. Scale variable enters in eight industries with a negative sign. Growth of output emerges as a significant variable in most of the Punjab manufacturing industries.

5.2) Policy Implications

The findings of this study have significant policy implications for the Punjab manufacturing firms and other related firms. Based on the study findings, the following policy implications can be offered.

The Punjab manufacturing sector is using higher inputs but still the performance in terms of productivity is low and needs to be improved. Most of the industries use more of capital input. Focus has to be concentrated on efficient use of capital. The growth of capital in the production, suggests that many manufacturing industries are moving towards more capital intensive production. This calls for steps to use capital judicially along with labour. The efficient usage of capital could make important productive contribution to the industrial sector of Punjab.

The study suggests that specific guidelines are required to increase labour productivity in industries in Punjab. Industries with low labour productivity require the introduction as well as better implementation of new frontier technology. Government policy should encourage investments which can lead to the introduction of new production technology. The cost and quality of products has to be considered as essential factors for increasing productivity. Policy formulation and implementation in infrastructure and competition have also to be considered crucial.

Besides this the incidence of employee training is to be enhanced for Punjab manufacturing to improve productivity. Large firms conduct more training than small firms and most training goes to skilled workers and managerial level officers. Focus should be laid on organizing suitable training programmes for all levels of workers to help the use of new technology efficiently. Training has a substantial effect upon labour productivity and increased training call result in higher productivity performance. The firms can take steps to improve productivity by imparting proper training to labour to equip them with new technical skills.

Punjab manufacturing is dominated by small scale enterprises. Small firms are constrained by available resources that can be allocated for adoption of new technologies. In fact, the level of technology used in these industries is quite low, which results in low productivity and poor quality of products, thus leading to competitive disadvantage both in domestic and global markets. These small scale firms have to be supported by the government to acquire new technology. These firms need to realize the benefits of new technologies for surviving the competition. Thus upgradation of technology is essential for most of the small scale industrial units. Credit facilities made available to the firms at low rates of interest will help solve this problem. Need based financing for technology upgradation, and meeting standards etc. should be allowed at low term deposit rates.

The research and development facilities available in the Punjab manufacturing are inadequate and investment in R&D is very low. The firms have to realize that R & D is the drive towards higher productivity. Investment in R&D should be increased to enhance productivity.

Besides this, new innovations can keep the countries on edge. The firms have to realize that R&D is necessary for survival as it creates and differentiates the products from competitors. The firms are not able to compete with low skilled products and higher labour cost. To survive, the firms have to compete in capital-intensive products, in which new R&D and skills are needed. Investment in R&D will result in improved quality of goods and increased range of goods. Hence the number of research centers, expenditure on R&D and percentage of employees in R&D activities should be increased.

5.3) Recommendations for Further Research

The present study deals with organized manufacturing sector and can be extended over to the unorganized manufacturing sector. Detailed analysis can be undertaken at primary level to see the impact of technology, especially technology adoption and technology adaptation on Punjab manufacturing. Investigations of impact of technology adoption along with the findings in this study will not only deepen the understanding of motivators and facilitators of technology adoption but also provide mare detailed directions for future research. By including extensive factors, a comprehensive framework of technology adoption and its rigor can be built. It would be useful to concentrate future research on determining the contribution of foreign capital and technology to the productive performance of the Punjab manufacturing industries. The firm level analysis can be taken up to see the impact of reforms especially by taking into account R&D intensity, investment climate and foreign direct investment.

An extensive survey based analysis along with the secondary analysis can be covered for in depth analysis of the subject analysis to analyse the state wise performance.

5.4) Significance of The Study

The present study will contribute in academic literature existing in the current field. The study has helped in analyzing the high performers and low performers of Punjab manufacturing as well as determinants of labour productivity. Thus the study can help in

taking adequate steps by Punjab manufacturing to enhance productivity and thus improve the performance of manufacturing sector as a whole.

5.5) Limitations of the Study

The limitations of the present study originate mainly from the database and the methodology used. Estimates of output and input in the present study are not free from certain biases. There are conceptual problems in the measurement of capital and these are very difficult to overcome. The standard methodology used in this study also has certain limitations. The measures of labour productivity growth based on certain assumptions have been frequently questioned in literature.

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