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Performances and Total Factor Productivity Growth (TFPG) of Indian Organised manufacturing Sector from 1980-81 to 2015-16

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Abstract: If the growth of total persons engaged is estimated, it is found that during the phase of 1980-90, the growth has been growing with an average 0.5 to 1 percent. During the foundation phase (1980-90) of economic reforms this slow growth shows a cause of concern for the optimism view for manufacturing. So, in terms of labour employment, the foundation stone of economic reforms in organized manufacturing sector has been on weak foundation, the growth of employment has been found at 2.78 percent. Does it then persist further, jobless growth? The expected line answer found is "yes". The stairs phase after 1990s of economic reforms has not able to uplift the growth of labour employment, and it is found with an average 2.75 percent during 1990-2001, however after this phase this argument of "jobless growth" has been invalidated with the help of the reviving output growth, value added, fixed capital and other improvement of manufacturing characteristics of the economy, the employment growth has been picked up as Goldar (2011) argues that employment in India's organized manufacturing has increased in recent years at the very rapid rate of 7.5 percent per annum from 2003-04 to 2008-09. At the same time, it is seen that the real value added growth for selected organized manufacturing during 1980-81 to 1990-91 has been 7.6 per cent and 5.8 per cent for 1990-91 to 2000-01. The growth of real value added again gained momentum and reached at an average growth of 7.9 percent from 2000-01 to 2010-11.

It is found that TFPG has declined for most of the manufacturing groups during 1990-2004 in comparison to the previous period. For overall manufacturing, the TFPG is found 0.027 and 0.014 for selected organized manufacturing from 2001-02 to 2015-16. The policy for organized manufacturing has to be devised in such a way that it enhances TFPG as well as absorbs the growing amount of labour force in Indian Economy. EPW Research Foundation data, Annual Survey of Industries and KLEMS data base of RBI has been taken for this study.

Key words: Organised manufacturing, Elasticity of Labour and Capital, Total Factor Productivity Growth, KLEM Translog Production Function, ASI, KLEMS data RBI

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I. INTRODUCTION

1.1 Performances of Organized Manufacturing Sector of India

The performances of the organized manufacturing sector showed remarkable improvement in terms of gross value added growth in the 1990s compared to the earlier period. There was also an increase in employment growth in this sector after 1990s, particularly in between 1990-91 to 1995-96 due to huge expansion of economies. But, the growth rate in fixed capital decelerated to almost half, resulting in a sluggish growth in capital labour ratio (Mitra, 2013). However, it is seen that the real value added growth grew at an average of 7.6 per cent for selected organized manufacturing during 1980-81 to 1990-91 and 5.8 per cent for 1990-91 to 2000-01. The growth of real value added again gained momentum and reached at an average growth of 7.9 percent from 2000-01 to 2010-11. If we see the growth of different characteristics in case of organized manufacturing groups, the highest real value added growth performance with 14.3 per cent is seen in case of coke, refined petroleum products and nuclear fuel; 11. 2 per cent is seen for rubber and plastic products; and 10.3 per cent is seen for electrical and optical equipment during 1980-81 to 1990-91. At the same time, during the phase of 2000-01 to 2010-11 the highest average real value added growth industries are seen in electrical and optical equipment with 13 percent; transport equipment with 11 per cent; machinery with 10 per cent.

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The organized sector currently accounts for about one fourth of total employment in manufacturing and about 70 percent of manufacturing output. Even though, the share of the organized sector in manufacturing employment is only about a fourth, it has placed itself as an important place for job creation because the level of productivity and wages are much higher in this sector than the unorganized one. Also, in terms of provision of decent jobs, the organized manufacturing sector has a clear edge over the unorganized manufacturing (Goldar, 2013).

It is not affordable to neglect manufacturing at this stage of development. Labor intensity of organized manufacturing sector has to be improved apart from increasing the productive employment in unorganized manufacturing sector.

Manufacturing sector is seen over a time period in Indian experience as a key driver to the industrial growth. Elasticity of employment in overall manufacturing has been stood higher at 0.44 while it is 0.35 for all other sectors. The employment growth for these two categories has been found 2.59 and 1.43 respectively during 1983 to 2004-05 (Dev, 2013).

The estimated result shows that paper and paper products; electrical and optical equipment have shown 6.5 per cent and 5.1 percent average employment growth respectively during 1980-81 to 1990-91. After the economic reforms the major performer in terms of average employment growth are machinery, rubber and rubber products, wood and wood products with 7.1 percent, 5.8 per cent and 3.8 per cent respectively. The productivity of organized manufacturing has also been found higher in comparison to agriculture, construction and unorganized manufacturing sector. Besides the less share of organized manufacturing employment in total employment, this sector has been believed to create skilled jobs which can alter India's demographic nightmare to a demographic dividend. Delhi Mumbai Industrial Corridor, National Manufacturing Policy, Delhi Kolkata Industrial corridor, National Investment and Manufacturing Zones, Foreign Direct Investment Policy initiatives and e- Biz project to promote ease of doing business in India have been formulated recently to revive faster manufacturing growth, larger export in general and sustainable employment for the growing labour force in particular (Economic Survey, 2012-13).

However, Mitra (2013) explains the National Manufacturing policy which promises to increase the share of the manufacturing sector to the country's gross domestic product to 25 percent from the existing 16 percent, but its objective to enhance industrial employment may not be realized as organized manufacturing employment comprises only a fraction of the total manufacturing employment. Out of many major reforms in 1991, manufacturing sector was specifically targeted due to the realization that the sector offered much greater prospects for capital accumulation, technical change and linkages and hence job creation especially for the semi-skilled and poorly educated segment of the labour force which comprises most of India's working poor.

With increased penetration of information and communication technologies since in mid 1990s in production process, there is a renewed interest to see what has caused productivity divergence among nations (Kathuria et al., 2014). This is because productivity growth has been recognized as a major contributor to economic growth. Economic growth depends both on the use of factors of production such as labour and capital, the efficiency in resource use and technical progress. This efficiency in resource use is often referred to as productivity.

The relevance of economic growth is less meaningful if it has not affected productivity growth hence the standard of living (Balkrishnan and Pushpangadan, 1998). This increase in productivity growth or productivity can be caused by several factors including investment in human capital, infrastructure, research and development and a healthy business environment. For developing nations infrastructure as a key input have been established (Mitra, 2016).

So, three different views exist on what TFPG is, the conventional view explains TFP as the measure of technical change (Krugman, 1990). The second view regards that TFP measures the technical change that is associated with externalities and scale effects. But, the third view is highly skeptical whether TFP measures anything (Gilriches, 1995). This concept gained momentum when it was realized that in the long run the input growth is subject to diminishing returns and will be insufficient to generate high output growth (Mahadevan, 2003). It is well acknowledged that the economic growth depends both on the use of factors of production such as labour and capital, the efficiency in resource use and technical progress. TFP measures the increase in total output which comes from other than the input used. Growth in TFP is therefore the growth in the total output less than the growth in the total inputs (Kathuria et al. 2014).

Dale Jorgenson of Havard University and many other researchers across the globe are engaged in constructing TFPG measures for all industries in a given economy based on service measures of five inputs- capital, labour, energy, materials and services (KLEMS). The literature in the manufacturing sector in India has evolved over five decades.

Improvement in productivity in manufacturing has been one of the main goals for the economic policy reforms launched in India in the early 1990s. Many authors compare estimation of productivity based on

three major methodologies, namely, Stochastic Production Frontier, Levinsohn-Petrin method and Growth accounting using data sets compiled for the organized and unorganized manufacturing though estimates lack robustness (Krishna, 2013).

Improvement in technology or improvement in technical efficiency or by improving the economies of scale can bring productivity. To understand the hindrances for the manufacturing growth, decomposition of total factor productivity (TFP) into all the three components can be the key.

Most of the studies have seen it in aggregate level and have not emphasized the sub national level for all the industries of manufacturing sector. Some studies (Mitra 2002; Trivedi et al. 2011) have examined the issue at state level; they have hardly attempted a decomposition of TFP into all its components.

Here is an analysis on organised manufacturing, using simple regression and the non-stochastic frontier analysis method, is to investigate what happened after economic reforms on growth of output and other characteristics of organized manufacturing including total factor productivity growth in the same registered sector in India. So, it is an attempt to examine the performances of organized manufacturing after 1980s and to see whether output growth and total factor productivity growth go hand by hand or otherwise. This study tries to capture the performances of organized manufacturing sector in terms of growth rate of some of its main characteristics like real value of output, gross value added, fixed capital, labour, material and energy consumed in India during the economic reforms and thereafter, i.e. 1980-2016. There are 14 major organized manufacturing industries with 14 major states are taken for the estimation in this paper and total of that share has been taken as proxy for all India characteristics of registered manufacturing. GIS software has been used to map the labour and capital productivity of organized manufacturing of major states of different time periods of India.

Here we rely on the assumption that the process of economic reform started from 1980s, and the structural break is the 1990 with reference to previous literature on economic reforms in India.

This paper has been divided into several sections. In the first, brief introductions to the TFPG of manufacturing sector and an overview of performances of this sector have been given. In the second, a broad review of literature related to productivity growth has been placed. Data and methodology have been analyzed in the next part. Again in the next, this paper takes care of the estimation and analysis of results with the help of tables and graphs and the last part this paper concludes with its own insights and limitations.

II. REVIEW OF LITERATURE

Researchers have estimated the partial productivity of manufacturing sector which is confined to the analysis of labour and capital productivity. Later they came with analysis of individual industry performance, inter-industrial and inter-regional comparisons of productivity change with the help of multi-factor productivity a Tinbergen (1942) explains labour and capital productivity as first one is the output per unit of labour and second is the output per unit of capital. It is useful to have a composite measure of productivity which relates output to all the conventional input simultaneously. The concept of total factor productivity defined as the ratio between real output and real factor input while he tried to have an international comparison of productivity growth.

Stigler (1947) develops the concept independently and suggested that a measure of real total factor input could be obtained by weighing inputs by their marginal products. Abramovitz (1956) observes the growth of output occurring due to factors other than an increase in inputs. Solow (1957) measured total factor productivity (TFP) as a shift in the production function. Since then there are increasing number of studies on TFP. Productivity growth is a crucial factor in determining growth of an economy.

Griliches (1960) and Dension (1962) extends the principle of weighing inputs by their marginal products to components of labour input. This system of weighing is now common practice in productivity studies. It is implied by the necessary conditions for producer equilibrium in competitive factor market. Mukherjee (1975) conducts a comparative study of the productivity trends in the large scale manufacturing sector of Bihar relative to the productivity trends at the all India level but could find no systematic trend at the state level. There is a declining trend in factor productivity both at the state and all India level. State level represents high level of marginal decline. Krishna (1987) has reviewed the trends in industrial production and productivity since 1950.

It is mentioned that productivity growth are a major contributing factor in the economic growth of many industrialized countries. In recent three decades, various studies have focused on source of productivity growth, yet there has not been a consensus selecting the attention of the root of productivity. Some of the researchers are focused to find out the impact of trade policies on the growth of total factor productivity. Dholakia (1989) states labour productivity can be defined as the multiplication of capital per worker and capital productivity.

$Y/L = (K/L)* (Y/K)$

Where Y, K and L are income, capital and labour respectively. Thus (Y/L) is labour productivity; (K/L) is capital per worker and (Y/K) is capital productivity.

Radhakrishnan (1990) in his analysis of partial productivity growth identifies that there was a general rising trend in labour productivity and a falling trend in capital productivity over the entire period of analysis of the whole manufacturing sector.

The pre and post 1970 inter temporal comparison showed significant deceleration in the growth rates of both labour and capital productivity during the second period basically. Trivedi et al. (2000) estimates TFPG for the period 1981-82 to 1990-91 and 1990-91 to 1997-98 where she has found that the annual total factor productivity growth is 3.06 and 1.96 respectively.

Unni et al. (2001) finds TFPG as -0.26, 4.00 and -1.28 for the period 1978-79 to 1984-85 and 1984-85 to 198-90 and 1990-91 to 1994-95 (Goldar, 2014).

Unel (2003) investigates the productivity trends in Indian registered manufacturing sector during the period 1980s and 1990s. His study found that labour and total factor productivity growth in total manufacturing and many of the component sectors since 1980 were markedly higher than that in preceding two decades. The estimation shows that Total Factor Productivity Growth (TFPG) ranges between 0.9 and 3.1 percent. The comparison in productivity suggests that labour and factor productivity trends in most of the sectors are significantly higher after 1991 reforms. Justifying the argument, the estimation showed that average annual growth rate of TFPG in aggregate manufacturing is 1.8 percent per annum for the period of 1979-80 to 1990-91 and 2.5 percent per annum for the period 1991-92 to 1997-98. The study has also presented the elasticity of output with respect to labour to be 0.6 percent rather than taking elasticity to be equal to the income labour share. The average annual growth rate was 3.2 percent during 1979-80 to 1990-91 and 4.7 percent during 1991-92 to 1997-98.

Viramani (2004) examines an increase in the growth rate of TFP in total manufacturing period of a period 1980-81 to 1991-92 and thereafter up to 2003-04. But a study in the year 2007 of Bosworth, Collins and Viramani found a fall in the growth rate in TFP combining organized and unorganized manufacturing sector. Goldar (2004) estimates TFPG citing the studies of Unel (2003) on productivity trends in Indian manufacturing. The contradicted Unel's findings and criticized his methodological inadequacies in input measurement. This study showed the indication of slowdown in TFPG in Indian manufacturing of the post reform period. Dash *et al.* (2010) estimated the TFPG of manufacturing to know the structure and growth of registered manufacturing sector.

Banga and Goldar (2007) estimate the contribution of services to output growth and productivity in Indian organized manufacturing sector as it plays an important role as an input to the production process.

Using panel data for 148 three digit level industries for 1980-81 o 1997-98, they have shown the role of services input to output and productivity growth has increased substantially after1990s may be due to trade reforms. Viramani and Hasim (2011) in their previous paper in 2009 had showed that the pattern of productivity growth at macro level resulting from the 1990s reforms was in the line with the prediction of the J-curve hypothesis and the manufacturing sector was entering into the upper portion of the J-curve. The present study of them was able to demonstrate quite convincingly that TFPG in manufacturing sector indeed follow a J-curve pattern as a consequence reform of the 1990s.

The RBI development research group Trivedi*et al.* (2011) estimates TFPG for the period 1980-81 to 2003-04 of the total organized manufacturing sector as 0.92 percent per annum by growth accounting approach which is almost half of that obtained by the production function approach, i.e. 1.81 percent per annum (pcpa). The contribution of the TFPG by these two approaches to the growth of output lies between 13 to 25 percent. The interstate performance of TFPG of organized sector across the states by growth accounting approach indicates that Bihar, Rajasthan, and AP turn out to be best performers while the worst performers are Tamil Nadu, Gujarat and Punjab. Bihar exhibits the highest TFPG of 1.55 pcpa and Tamil Nadu shows 0.65 pcpa. It is because there was a negative growth rate (-1.81) of employment of Bihar during that period while Tamil Nadu witnessed the growth rate of employment of 2.5 pcpa.

In the book productivity in Indian Manufacturing (Kathuria et al., 2014), Parameswaran examines the productivity growth of manufacturing sector in India with two sources of productivity growth namely resource allocation and catching up after economic reforms. Using firm level panel data from 1992-93 to 2005-06, his study shows that the portion of productivity growth accounted by the reallocation of resources to more productive firms is not only significant but also increasing over time in majority of the industries. He finds exporting firms have higher productivity and that resource allocation to that exporting firm increased industry level productivity.

Datta (Chapter 8) also measures TFPG for two sub periods 1980-81 to 1990-91 and 1990-91 to 2003-04 and for the whole period, she explains organized manufacturing have done well in terms of TFPG in the decade prior to liberalization in comparison to the post liberalization. She also points out that there is a fall in TFPG higher during 1995-96 to 2003-04.

Mitra et al. (2016) establishes core infrastructure and information technology (ICT) matter for TFPG examining eight manufacturing industries for the period 1994-2008. Core infrastructure impact on TFPG is stronger in comparison to ICT though it varies among industries. 1% increase in infrastructure leads to 0.32 percent increase in TFPG on overall manufacturing on an average. There result supports the idea that a lack of infrastructure can hamper growth in developing countries.

III. OBJECTIVES OF THE STUDY

1. To estimate the rate of growth of gross value added, output growth, number of factories, fixed capital of organized manufacturing sector during foundation phase of economic reform (1980-1990) and the stair phase of economic reform (1990-2004) in India. And updating the same is targeted for the future time period up to the availability of data points.
2. To estimate average share of labour and capital productivity and the rate of growth of elasticity of capital and labour w.r.t to Gross Value Added of major states in India during the foundation and stair phase of economic reform.
3. To estimate the TFPG of organsied manufacturing groups in India after economic reform, i.e. 1980-81 to 1990-91 to 1990-91 to 2003-04 and for the whole period.

IV. HYPOTHESES

1. The growth rate of characteristics of organised manufacturing has a declined trend over the time period
2. The foundation phase of economic reform sees higher labour productivity of organised manufacturing in India in comparison to stair phase
3. TFPG has increased over the period of time since 1980s.

V. DATA SOURCES AND VARIABLES

Annual Survey of Industries (ASI) is most comprehensive source of manufacturing data. ASI is conducted every year, but the results are available at a time lag of 2 to 3 years. A structured and detailed schedule is used to collect the data filled in by the persons of the Field Operation Division (FOD) of National Sample Survey Organization (NSSO) and is based on the statement of the unit (Singh, 2012). The ASI extends to the entire country except the States of Arunachal Pradesh, Mizoram and Sikkim and Union territory of Lakshadweep. It covers all factories registered under the section 2(m)(i) and 2(m)(ii) of the Factories Act, 1948 i.e. those factories employing 10 or more workers using power ; and those employing 20 or more workers without using power (Nath,2005). Here in this paper, EPW Research foundation data and ASI reports have been used. It is also explains in the following how the variables from these sources have been used. The data from1980 to 2004 has been considered with two time phases, one up to year 1980-1990 and another thereafter up to 1990-2004. The 2 digit level organized manufacturing sector has been taken according to the National Industrial Classification (NIC) 1998 including 14 major states with 14 major manufacturing groups. After 2004, KLEMS data base of RBI has been used to update the paper up to 2015-16.

5.1 Capital Construction (K)

There is no unique method to measure real capital, but it is necessary to find out a way to measure real capital and that has been focused by various researchers. These researchers have found both theoretical and empirical problems in measuring capital stock. Goldar (1986) looked at the conceptual problems of estimation and reviewed the short comings of the various existing estimates of capital stock for Indian manufacturing sector. He found there is always a dilemma in selecting either gross fixed capital formation or net fixed capital formation as the measure of capital input. Ideally for purposes of economic analysis, it is desirable to use the estimate of net capital stock provided a reasonable measure of true economic depreciation which can be found out. But existing estimation of depreciation are either tax based accounting concepts or based on certain rules of thumb. So this dilemma is there.

The next problem relates to the measurement of a time series real capital. Perpetual inventory method is usually used to measure capital. In a step by step process time series of stock of capital is measured from investment and price of capital goods. Careful attention is paid to obtain the base year capital stock, obtaining an appropriate deflator and making allowances for discarding assets (Goldar, 2004).

Gross fixed capital stock at constant price can be obtained as follows:

The measure of capital stock includes land and excludes working capital. Working capital has been excluded in many earlier studies including Goldar (2004). The estimates of capital stock are also gross of depreciation. The perpetual inventory method is used to obtain the time series on capital stock. Let K_0 denotes the base year capital stock, I_t the gross investment at base year prices in fixed assets in year t. Then fixed capital stock in year T denoted by K_T is given as follows:

$$K_T = K_0 + \sum_{t=0}^{T} I_t$$

The gross investment is equal to $I_t = [B_t - B_{t-1} + D_t]/P_t$,

where B_t stands for the book value of fixed assets at the end of year t. D_t is the amount of depreciation allowances made during year t is taken at 10 percent (Trivedi, 2011, pp. 73),. $P_t$is the capital goods price deflator. But the deflated figures of capital with its book value have been used here (Goldar, 2004, pp. 8). Fixed capital here has been deflated by average of electric and non- electric machinery wholesale price index.

5.2 Labour Input (L)

In the case of labour, the stock available to the industry is the number of persons employed by it during a year. The ASI publishes annual data on workers as well as employees and either of them can be used as a measure of labour input. Total employees as a measure of labour inputs include both workers as well as persons other than the workers. Persons other than workers consist of Supervisor, technicians, managers, clerks and other similar types of employees. They are important for getting the work done as the workers who operate the machines and therefore their services should be taken into the measurement of labour input. Here Total persons engaged (has been taken as a measure of labour input). Using total employees as a measure of labour input thus involves the assumption that workers and persons other than workers are perfectly substitutable. This is clearly an assumption which is not realistic and is thus a limitation of this measure of labour input (Singh and Singhal, 1985).

5.3 ***Value Added (V)***

To convert nominal value added to real value added, WPI series for each sector has been used. There are different series of WPI, the method of splicing is used for these series to find out overall WPI series at a given base year price. The detailed categories for which the wholesale price data are available do not match exactly with the two digit classification of the ASI. A close and detailed scrutiny of the available data is required before selecting the suitable price deflators. Hence output can be measured in terms of both value added or gross output.

In this present study gross value added has been used as more relevant measure keeping the previous researches in mind. Dash et al. (2010) in an IGIDR paper have argued in favor of gross value added as a good measure of output, he argued depreciation figures are not reliable as the entrepreneurs often provide data with inflated figures to avoid tax-laws.

5.4 ***Material Used and Energy Consumed***

The data on material consumed and energy consumed are also taken to measure the total factor productivity as examined in the methodology part. For energy, fuel consumed has been taken as the proxy and all these have been deflated with relevant prices.

VI. METHODOLOGY

6.1 Growth Rate Calculation

For calculating the Compound Annual Growth Rate of indicators of manufacturing, the following widely used formula is used,

$Y_t = Y_0 (1+r)^t$

Where we can takeY_t, Y_0,as either value of output and employment or any other share of manufacturing in terminal year and base year respectively, r is growth rate and t implies number of years.

Taking logarithm both the sides Log Y_t = log Y_0+ t log (1+r), if log Y_0 is taken as „a" and log (1+r) as „b" then these coefficient by regressing log of $Y_t$on time variable i.e. number of years can be found. b = log $(1+r)^t$ and

$\Rightarrow$(1+r) = Antilog (b) Or „r"= (Antilog (b) -1) $\Rightarrow$ $LnY = a + bt + U_t$

The regression coefficient "b" yielded an estimate of the trend of Compound Annual Growth Rates when it is estimated finding the exponential of "b" deducting 1 and multiplying 100. It is like (Exp (b)-1)* 100, which is the Compound Annual Growth Rate for dependent variables. Here the aim is to find out the growth rates of Output, net value added, employment, capital, and number of factories for manufacturing units as well as for states, regressing with respective time periods. Here Y will indicate value added and employment and other shares respectively (Gujurati and Sangeeta, 2007; Malick, 2012).

6.2 Total Factor Productivity Growth Measurement

The two most commonly used measure of productivity are single factor and multi factor or total factor productivity. Total factor productivity can be measured with two different approaches, one is frontier approach and another one is non-frontier one and further it is divided into parametric and non-parametric approaches. In frontier approach identifies the role of technical efficiency in overall firm performances, whereas the non-frontier approach assumes that firms are technically efficient. The TFPG results from frontier approach consists of two components- outward shift of production function resulting from the technological progress and technically efficiency related to the movement towards the production frontier. The parametric approach employee's econometric techniques, the deviation from the actual output from the maximum output is decomposed in two parts, i.e. the statistical noise and the inefficiency (Kathuria et al. 2014). A functional form more flexible than Cobb-Douglas and Constant Elasticity Substitution Production function was developed by Christensen, Jorgenson and Lau (1971, 1972). This functional form is known as transcendental logarithmic or the translog production function

In this paper, parametric non frontier approach has been used. To be specific, growth accounting approach (GAA) has been used instead of others.

The objective of the GAA is the separation of change in production on account of change in the quantity of factors of production from residual influences, viz. technological progress, learning by doing, managerial efficiency etc. TFP growth proxies these residual influences. The origins of GAA can be traced back to solow and Tinbergen(Kathuria et al. 2014). Keeping the superiority the Theil-Tornquist or Translog Divisia Index has been taken for this paper.

This index provides consistent aggregation of inputs and outputs under the assumptions of competitive behaviors, CRS, Hick Neutral Technical Change and input output separaibility. They are superlative under very general production structure, non homogenous and non constant returns to scale.

$$TFPG = (lnQ_t - lnQ_{t-1}) - \sum_{i=1}^{n} 1/2(S_{i.t} - S_{i.t-1})(lnX_{i.t} - lnX_{i.t-1}$$

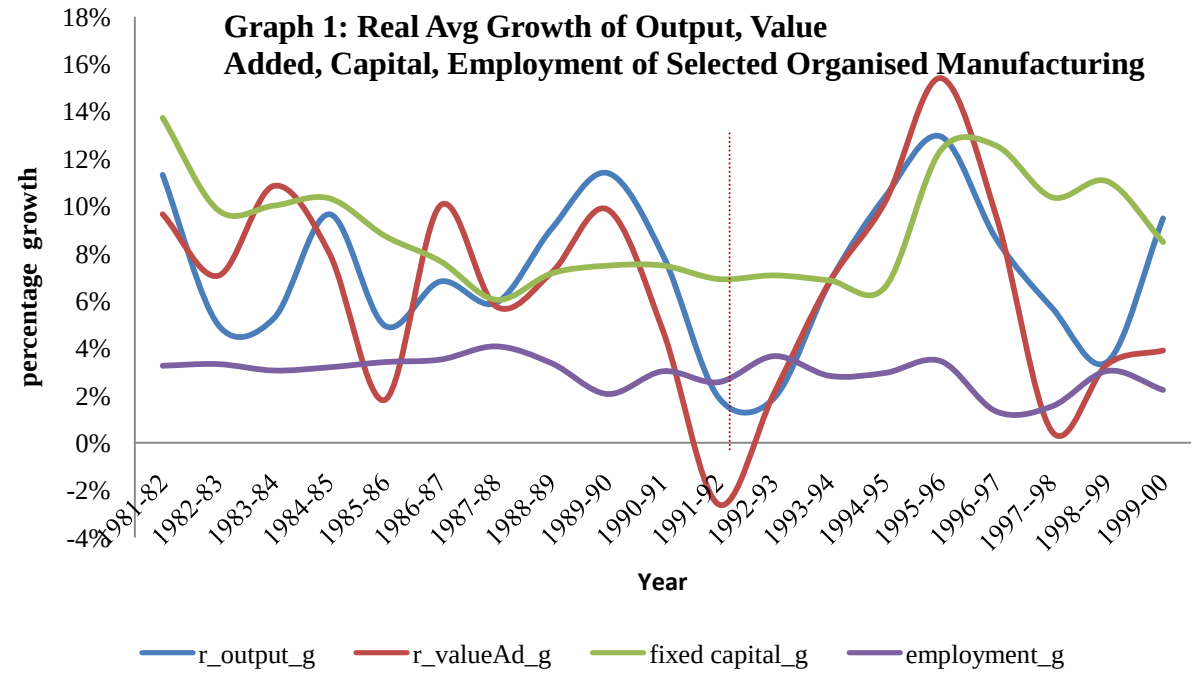
Where Q denotes output, X_i denotes factors of production and S_i denotes share of factors of production in total output at current prices.

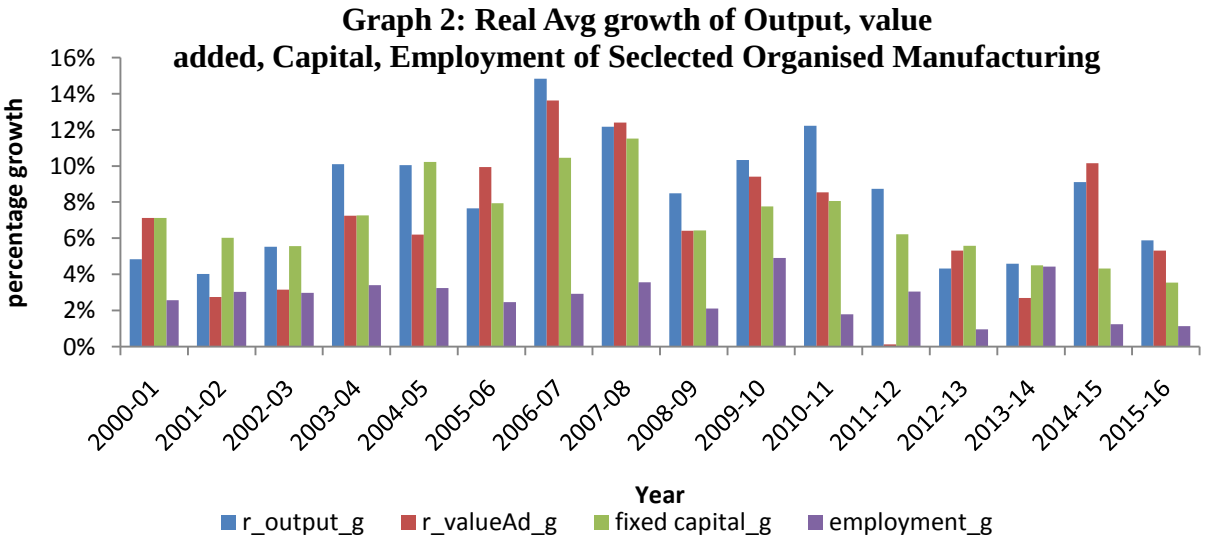
VII. ANALYSIS AND DISCUSSION

7.1 Analysis of Growth of Manufacturing Characteristics

From the year 1980-85, the real value of gross output has been increased tremendously except the year 1983-84, and the true shift in output has occurred during 1992-96 with an average almost near 15 percent. After 2000, the average growth rate of real gross output has actually been very satisfactory as it has been shown in the following grap. The other indicators of organized manufacturing the growth of the real gross value added have been actually taken place during the phase of 1992-96.

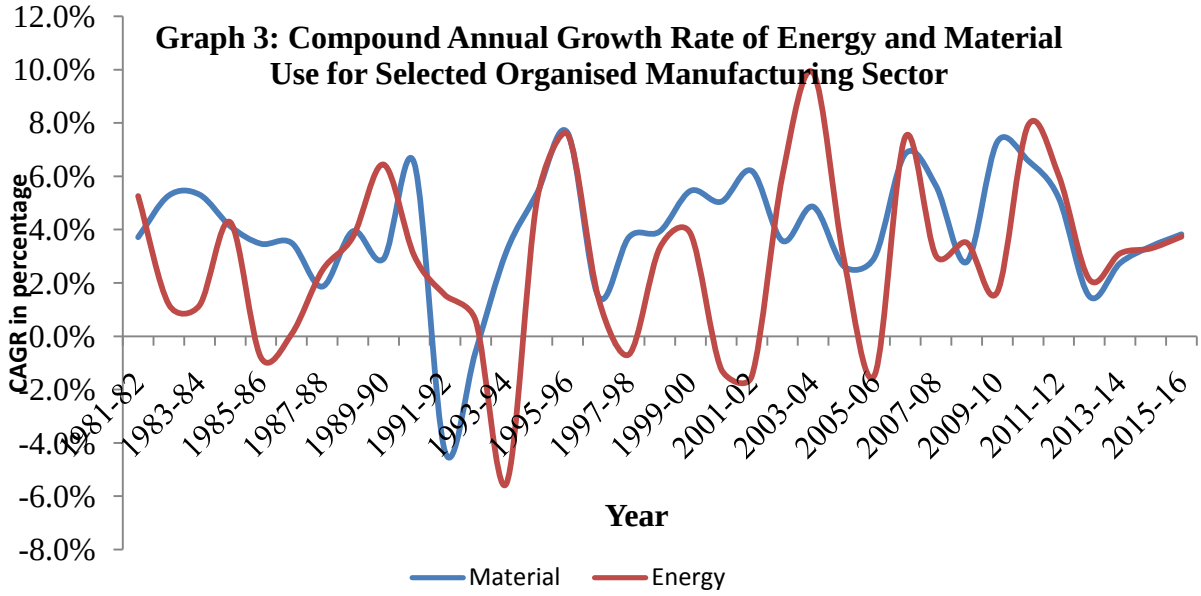
If we look at the growth of total persons engaged, it is found that during the phase of 1980-90, it has been growing with an average 0.5 to 1 percent only and this is a cause of concern for the optimism view regarding manufacturing during the *foundation phase* of economic reforms. So, it can be said in terms of labour employment the foundation stone of economic reforms in organized manufacturing sector has been very weak. Does it then persist further? The obvious answer is "yes". The *stairs phase* of economic reforms has not been able to uplift the growth of labour employment instead of the reviving output growth and other conditions of the economy.





The growth of fixed capital during the phase of 1980-90 has not been encouraging. It has been lying within 4-5 percent on an average. The period 1992-96, the growth of fixed capital has been more than 7.5 percent. However, the period after 2000 the increase in fixed capital growth has been abysmally low. There is an evidence of fluctuating trend in case of growth of real gross value added, though it has been positive averaging more than 3 percent during the phase 1980-90.

7.2 Analysis of Labour and Capital income share in gross output, energy and material use for selected organized manufacturing.

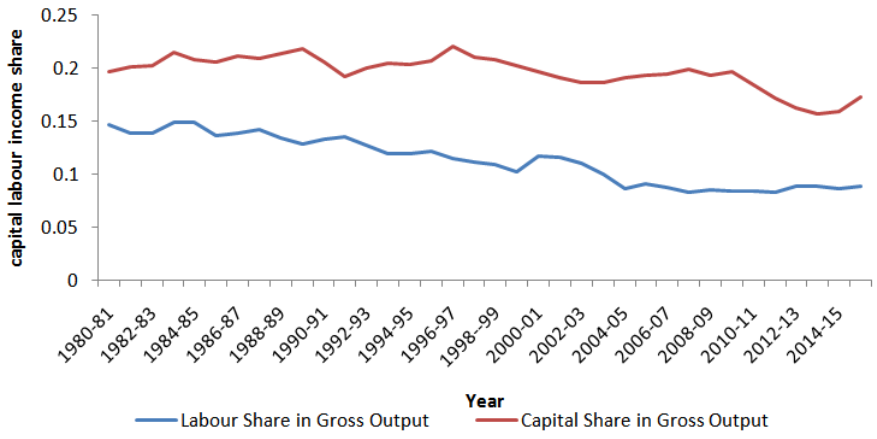


The material and energy used for the selected manufacturing sector has been picked up after 1984-85 and then the growth rate of these two characteristics has been declined. Again the same has been picked up after 1994-95. The main drivers of material use are coke, refined petroleum products, nuclear fuel; Food products, beverages and tobacco; Basic metals, and fabricated metal products in absolute terms over a period of time from 1980s.It is seen that after 1990s material use in transport equipment and after 2000s in textile and textile products has picked up. But the highest growths in material use from 1980 to 2016 are seen in case of Chemicals and Chemical Products; Rubber and Plastic Products; Other Non-Metallic Mineral Products; Electrical and Optical Equipment; Transport Equipment; and Transport Equipment. The compound growth for these industries in material input has been more than 10 per cent.

The lowest growth in these periods in material use is seen for wood and wood products showing only 3 per cent compound growth over 36 years time period owing from 1980 to 2016.

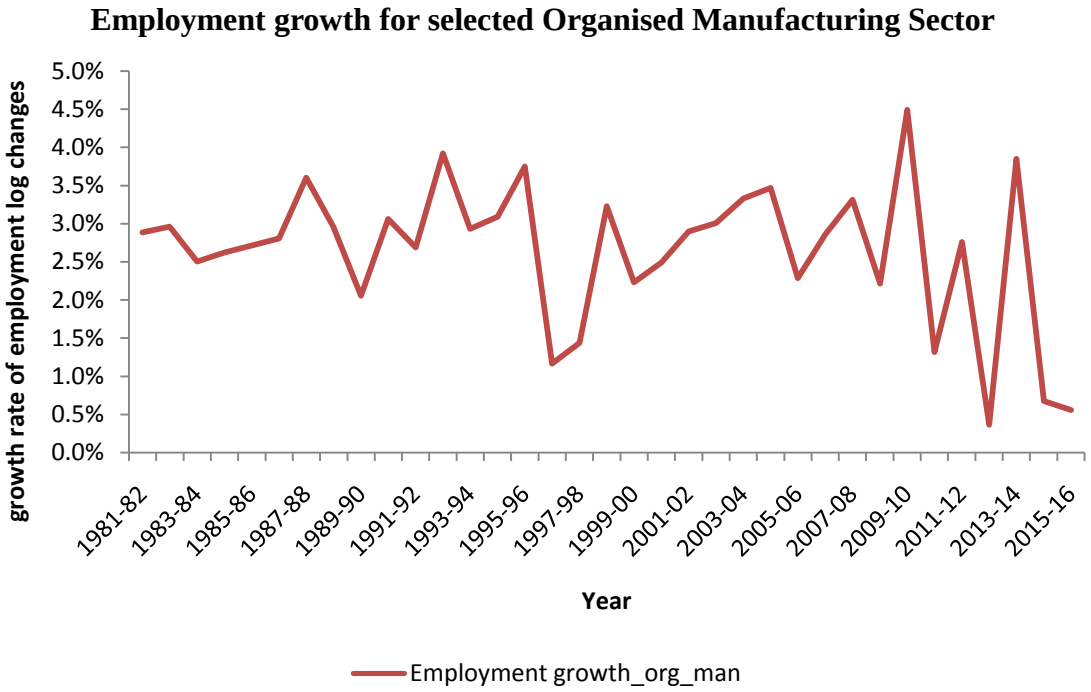
The main drivers of energy input in absolute terms in manufacturing sector has been seen for Basic Metals and Fabricated Metal Products; Chemicals and Chemical Products; and Other Non-Metallic Mineral Products including textile and textile products. It is also seen that historically these industries are using highest energy inputs at least since 1980s. Coke, Refined Petroleum Products and Nuclear fuel; Rubber and Plastic Products; Basic Metals and Fabricated Metal Products; have seen an average of more than 7 per cent compound growth over a period from 1980-2016

Graph 4 Labour and Capital income share in gross output for selected organized manufacturing



In case of the capital income share it is seen that this has been increased consistently after 1984-85 and then drops during 1989-90 and again picked up from 1990-91 up to 1996-97. And the same trend of growing capital income share has been seen from 2013-14. The labour income share has been declining since 1990s and the year 2000 has been picked up and then again falls persistently. The labour income share has been stagnant since 2007-08. The capital share is showing an increasing trend as it has shown the same trend after the economic reforms of 1990s. in most of the cases increase in capital share income of output has been complemented by fall in labour income share.

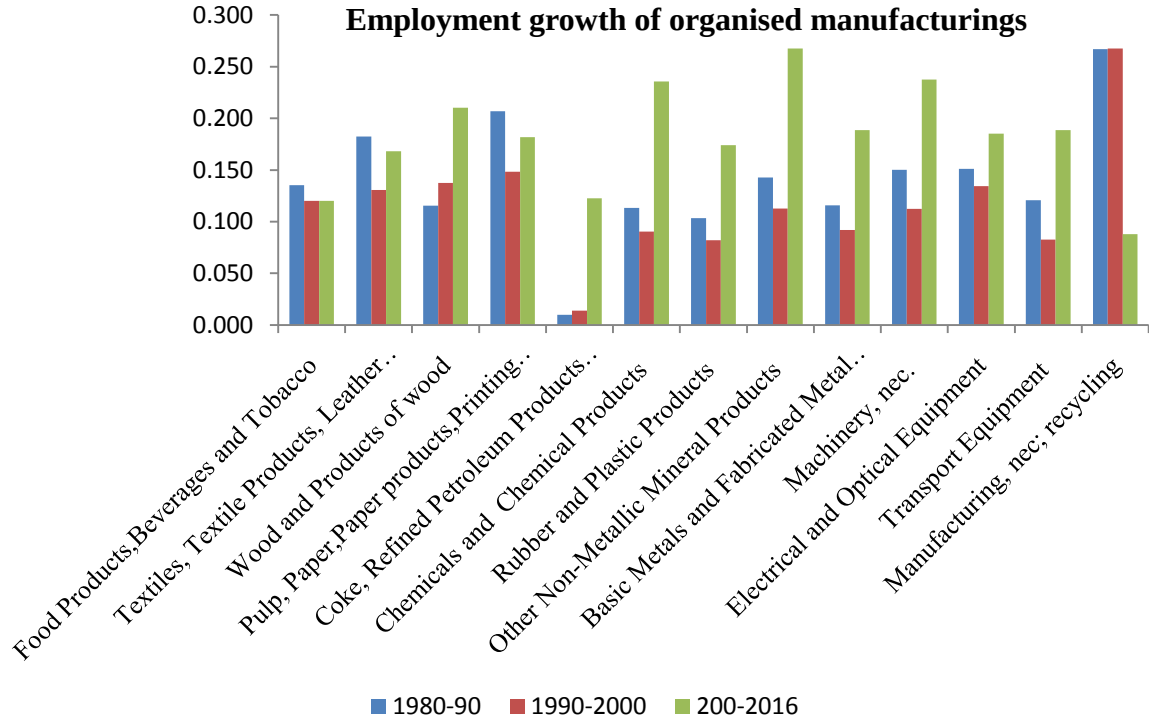
Graph 5 Employment growths over a period of time for organized manufacturing in India



The employment growth has seen a very fluctuating trend over a period of time. The employment growth increased sharply after the economic reforms and fell down sharply after a revival phase of 1999-00 to 2004-05. The employment growth in the last recent three periods has also shown a declining a trend for the selected groups of organized manufacturing sector in India. The highest employment growth during 1980 to 1990 has been seen in case of Rubber and Plastic Products; Pulp, Paper and Paper Products; Chemical and Chemical Products as well as in Basic Metal and Fabricated metal products. during 1990 to 2000 highest employment growths are seen in case of Machinery; Rubber and Plastic Products; Wood and Wood Products; Food and Food Products.

Over the period of 2011-2016 employment growth more than 11 per cent is seen for Electrical and optical equipment; 6.30 percent for Transport equipment; 5.2 per cent for Rubber and plastic products.

Graph 6 Employment growths industry group wise for organized manufacturing in India



VIII. ANALYSIS OF LABOUR AND CAPITAL PRODUCTIVITY IN ORGANISED MANUFACTURING OF MAJOR STATES IN INDIA

If we look at the trend of labour productivity and capital labour ratio, it is found that there is an increasing trend of labour productivity as well as capital labour ratio. As capital labour ratio increases, in the stair phase of economic reforms, the elasticity of labour productivity has jumped to 0.025 to 0.08 during the said phase 1990-2004. So, the capital labour ratio increases means, the use of capital also increases in the production process in relation to labour.

So, labour productivity has increased and it is also found that the total amount of labour employment has fallen during the same period. But, as it is found in foundation phase, the use of capital and labour in organized manufacturing sector has been taken in a balanced manner. But if we see, from 1985-86, the use of capital in organized manufacturing sector has shown an increasing trend by which the capital productivity has been started picking up from 1990-91 also. It may show the use of larger share of capital has boosted the productivity of the same input as well. Hence, the growth of elasticity of capital to GVA has been higher after the phase of 1990-91 and the growth of elasticity of labour productivity has been fluctuating and somewhere goes to negative in these sectors.

Using the Geographical Information System (GIS), it is also mapped the average share of productivity of both labour and capital for 14 major manufacturing states in India. These states are Andhra Pradesh, Tamil Nadu, Kerala, Karnataka, Maharashtra, Gujarat, Rajasthan, Uttar Pradesh, Odisha, West Bengal, Madhya Pradesh, Bihar, Haryana, and Punjab. These states are responsible for more than 90 percent manufacturing share in India and the other 14 major manufacturing groups of these states are also responsible for more than 95 percent of manufacturing activities. Food and food products (20_21), Beverage, tobacco, tobacco products (22), Textile (23_24_25), Textile products (26), Wood and wood products (27), Paper and paper products (28), Leather and leather products (29), Chemical and chemical products (30), Rubber and plastic products (31), Nonmetallic mineral products (32), Basic metal and alloy (33), Metal products, non elec. Machinery (34_35_36), Transport Equipment (37), other manufacturing (38). So, taking individually and the summation of these manufacturing groups as proxy for organized manufacturing of India has been estimated and it seem quite logical.

During the foundation phase of economic reforms, labour productivity in organized manufacturing has been higher in some states like Maharashtra, Madhya Pradesh, Uttar Pradesh and Odisha. But in the stair phase of economic reforms, almost the western states of India and southern states except Andhra Pradesh, Tamil Nadu and Kerala, has shown very high labour productivity. However, these states like Tamil Nadu; Andhra Pradesh has shown higher productivity of labour in stair phase of economic reforms in comparison to higher labour

productivity states Maharashtra and Madhya Pradesh during foundation phase of economic reforms. Again, in terms of capital productivity the attention has shifted to peninsular states during 1990-2004 like Maharashtra, Karnataka and Tamil Nadu.

8.2 Analysis of Total Factor Productivity Growth of Organised Manufacturing Groups in India

The productivity growth of food and food products (20_21) has been declined from the foundation phase to stair phase. But for the period 1980-2004 the productivity growth stands at 0.0248. Most of the 14 major manufacturing industries and TFPG have declined from 1980-81 to 1994-2004 except textile products (26), rubber and plastic products (31), non-metallic mineral products (32) and other manufacturing (38). The highest total factor productivity growth has been for chemical and chemical products (30), non-metallic mineral products (32), other manufacturing (38). During 1980-90 while for the period of 1990-2004, the manufacturing groups are textile products (26), rubber and plastic products (31), non-metallic mineral products (32) and other manufacturing (38).

For the overall time period, the TFPG is highest for textile products (26), non-metallic mineral products (32), and other manufacturing (38), chemical and chemical products (30), rubber and plastic products (31) in comparison to other manufacturing groups in India.

In terms of relationship between GVA and TFPG, TFPG explains very less variation in GVA during the overall phase of 1980-2004. Same is the case for 2004 to 2016.

IX. CONCLUSION

The policy has to be devised in such a way that not only increases labour productivity but also the absorptions of labour, National Manufacturing Policy may be one of the recent policy steps in this manner. As it is seen the performances of organized manufacturing has been picked up during 1990-95 while thereafter a sharp fall in the performances. The high fluctuations in these industries need to be addressed. The average Total Factor Productivity Growth from 1980-2004 is just 0.027 for orgnised manufacturing industries. The productivity may grow by increasing the technical efficiency in organized manufacturing. To show the quality of work as need to be uplifted and priority of the policy makers should be to create productivity enabling or boosting frame of policies.

Limitations of the Study

The time period of the data set for estimation could have increased to 2004 to 2012 which may give us clearer picture about the performances. Book value of fixed capital has been used; capital construction using the explained method in the methodology could have given good results. Fixed capital has been deflated by wholesale price of electric and non-electric machinery may be criticized. Single deflation method of gross value added that has been deflated by wholesale price of manufactured products may be criticized.

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Appendix

Table 1: Total factor productivity growth in Indian organized manufacturing 1980-2004.

Industry	TFPG(1980-91)	TFPG (1991-2004)	TFPG (1980-2004)
20_21	2.8%	1.8%	2.4%
22	2.3%	0.8%	1.7%
26	1.0%	-0.4%	0.6%
27	2.8%	6.5%	4.7%
28	1.0%	1.9%	1.3%
29	1.1%	-0.6%	1.0%
30	4.5%	-0.7%	2.7%
31	4.1%	2.2%	3.0%
32	2.5%	3.4%	3.6%
33	4.3%	4.9%	4.4%
34_35_36	2.0%	2.0%	2.3%
37	2.9%	2.3%	3.1%
38	2.9%	-0.3%	2.4%
	3.4%	4.8%	4.3%

Source: Author's Calculation from ASI data

Table 2: Total factor productivity growth in Indian organized manufacturing sector 2000-2016.

Sectors	TFPG (2000-2016)
Food Products, Beverages and Tobacco	1.17%
Textiles, Textile Products, Leather and Footwear	2.53%
Wood and Products of wood	-0.49%
Pulp, Paper,Paper products,Printing and Publishing	2.90%
Coke, Refined Petroleum Products and Nuclear fuel	2.73%
Chemicals and Chemical Products	3.41%
Rubber and Plastic Products	2.04%
Other Non-Metallic Mineral Products	-0.53%
Basic Metals and Fabricated Metal Products	-2.41%
Machinery, nec.	-0.51%
Electrical and Optical Equipment	2.80%
Transport Equipment	1.24%
Manufacturing, nec; recycling	3.02%

Source: KLEMS data base RB

Table 3: Real Value Added Growth of Organised Manufacturing (log changes)

Sectors	1981-90	1991-00	2001-10	2011-16
Food Products,Beverages and Tobacco	6.6%	5.9%	5.0%	6.6%
Textiles, Textile Products, Leather and Footwear	4.3%	6.3%	5.9%	8.1%
Wood and Products of wood	-2.1%	-0.6%	0.9%	3.1%
Pulp, Paper,Paper products,Print& Publishing	7.9%	2.1%	7.2%	5.3%
Coke, Refined Petroleum Products and Nuc fuel	14.3%	2.4%	9.5%	13.8%
Chemicals and Chemical Products	9.7%	8.7%	9.1%	6.1%
Rubber and Plastic Products	11.2%	10.7%	7.5%	6.0%

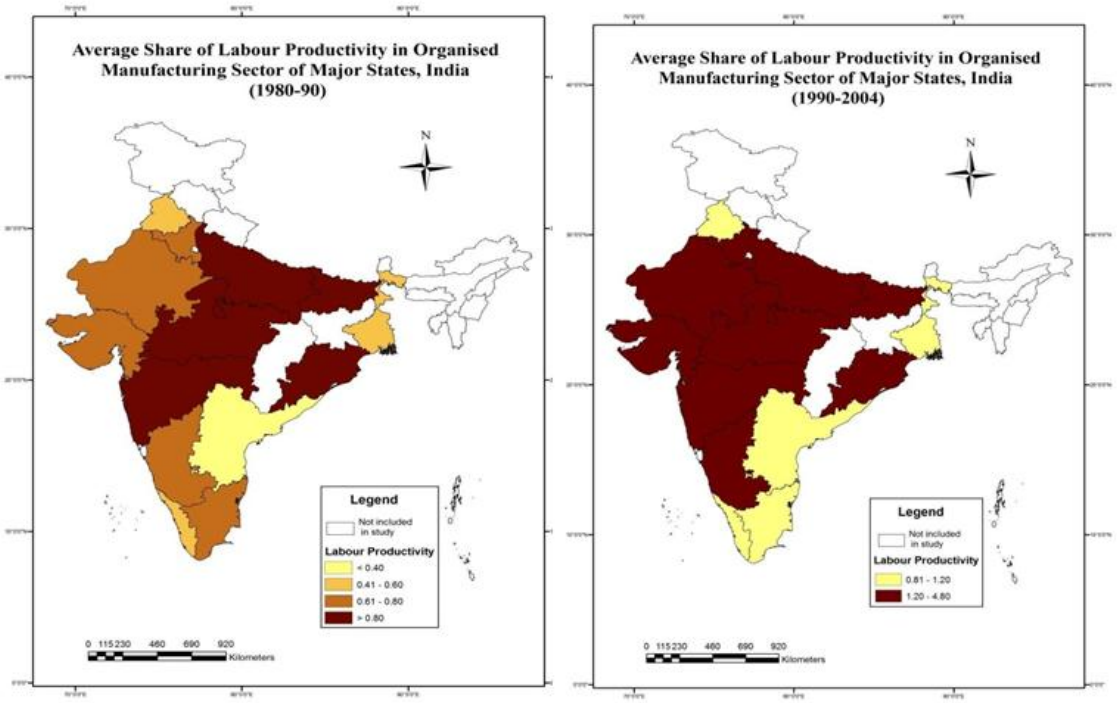
Other Non-Metallic Mineral Products	9.0%	6.9%	8.2%	2.9%
Basic Metals and Fabricated Metal Products	4.4%	6.1%	6.5%	2.4%
Machinery, nec.	8.1%	3.9%	9.9%	3.4%
Electrical and Optical Equipment	10.3%	6.5%	13.0%	2.6%
Transport Equipment	6.7%	6.6%	11.2%	8.4%
Manufacturing, nec; recycling	7.1%	6.7%	8.9%	9.5%

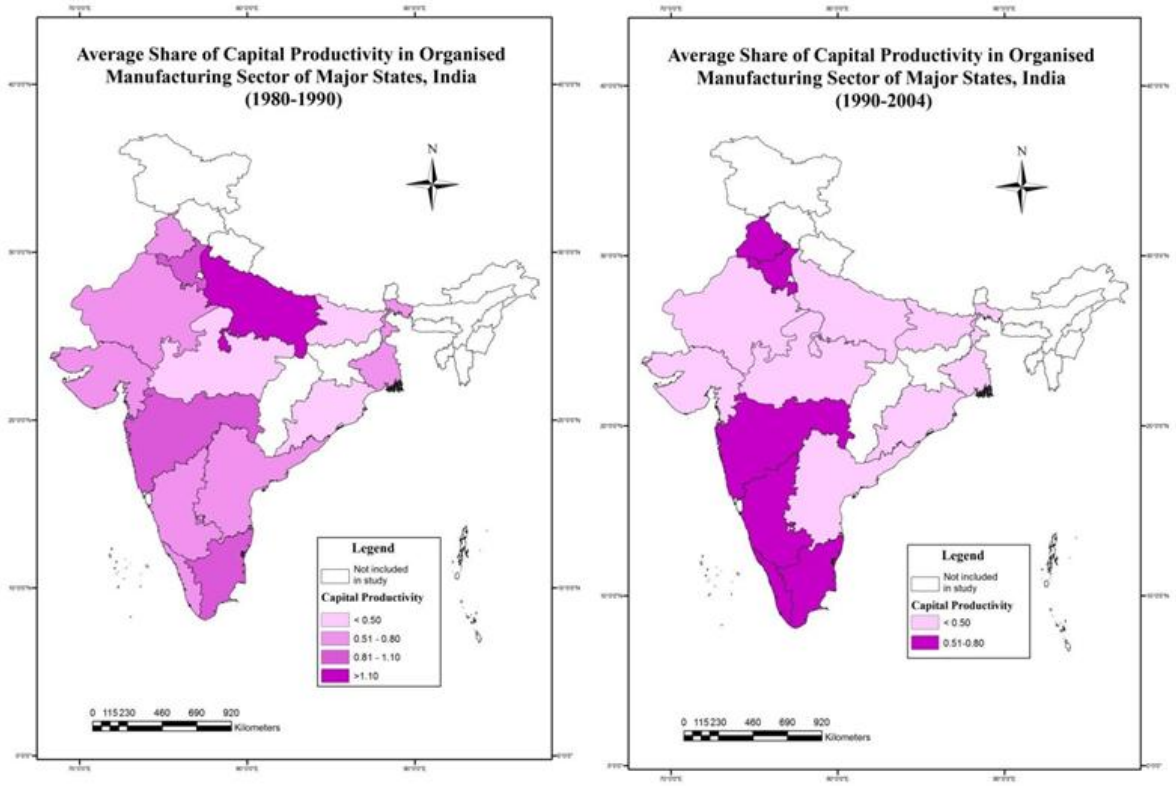
Source: KLEMS data base RBI

Table 4: Rate of Growth of Employment in Organised Manufacturing in India

Sectors	1981-90	1991-00	2001-10	2011-16
Food Products, Beverages and Tobacco	2.30%	2.70%	0.60%	1.30%
Textiles, Textile Products, Leather and Footwear	1.50%	-0.50%	2.70%	-1.40%
Wood and Products of wood	1.50%	3.80%	-0.10%	-4.60%
Pulp, Paper,Paperproducts,Printing and Publishing	3.20%	2.70%	2.60%	-1.00%
Coke, Refined Petroleum Products and Nucl fuel	2.80%	2.40%	4.70%	-0.80%
Chemicals and Chemical Products	3.60%	2.60%	1.20%	0.50%
Rubber and Plastic Products	6.50%	5.20%	3.40%	5.20%
Other Non-Metallic Mineral Products	1.80%	1.10%	3.60%	1.60%
Basic Metals and Fabricated Metal Products	2.80%	2.70%	2.10%	2.80%
Machinery, nec.	0.70%	7.10%	3.70%	4.60%
Electrical and Optical Equipment	5.10%	3.20%	4.60%	11.00%
Transport Equipment	-0.40%	1.70%	2.60%	6.30%
Manufacturing, nec; recycling	4.80%	1.00%	5.70%	3.70%

Source: KLEMS data base of RBI





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