Trend of Labor Productivity with Gross Value Added in India's Manufacturing Sector

Kanika S Tomar[1], Dr. Mahua Bhattacharjee[2], Dr Anjali Tandon[3]

[1]Research Scholar, Amity School of Economics, Amity University, Noida
[2]Dr. Mahua Bhattacharjee, Professor, Amity School of Economics, Amity University, Noida
[3]Dr Anjali Tandon, Associate Professor, Institute for Studies in Industrial Development, Delhi.

Abstract

The purpose of this paper is to study the trend of growth rate of manufacturing sector from 1980-81 to 2019-20 to identify the area of intervention to achieve the government target of increasing manufacturing sector share to 20% by 2025. The paper has utilized secondary data to show descriptive analysis using KLEMS database for aggregate economy and Annual Survey of India data for organized sector. It shows the trends of gross value added, labour income share, employment and labour productivity covering past 40 years depicting the several business cycles of recession and 2 years of COVID-19 impact. The major findings show that manufacturing sector is dominated by informal sector with 2/3 share of persons engaged, however, it only contributes only 1/3 to the gross value added. The labour productivity has been positive within few sub sectors with positive structural shift to labour productive sectors. The employment has also increased in the formal manufacturing sector manifolds than the informal sector which argues the need to fully transform the manufacturing sector into a formal sector. Though manufacturing sector has achieved higher growth rate since the Independence, comparatively it has under-performed within the sub sectors. The capital stock has substantially been in a negative direction since the 1980's to 2020's and the Total Factor Productivity increase can be seen only in 5 sectors out of the 13 sub industries under Manufacturing sector. So, the paper argues to focus policies towards capital stock and increase in the real wages by controlling inflation on necessities and promotion of MSMEs to promotes jobs to tap into the demographic dividend of India and increase standard of living.

Keywords: Manufacturing sector, Gross value added, Labour productivity, Informal vs. Formal sector, Capital stock and Total Factor Productivity

1. Introduction

India's Manufacturing Sector has matured over several years and achieved a share of 14.43% of the total Gross Value Added (2020-21). After the Independence in 1947, the government has adopted several Industrial policies to develop and improve the performance of the manufacturing sector. The post Independence Industrial Policy was introduced in the late 1950 to early 1960 paving way to widened scope of public sector, categorization of the manufacturing sector and License Raj. The Industrial Policy of 1977 was an extension of 1956 policy concentrating on employment for the poor, redistribution of wealth from rich to poor, decentralisation and imposed restrictions of Multinational Companies. These two industrial Policies majorly focussed on large & heavy industries with central control and

India only witnessed a 2% growth rate of labour and 0% increase in factor productivity [Ahluwalia, 1986]. The Indian government introduced another Industrial Policy in 1980's to focus on the sustained growth and development by promoting competition in the domestic market and upgrading technology.

The radical and much awaited change came in with the introduction of New Industrial Policy in the 1991 with the focus on efficient and expedited growth. The Liberalization led to reduction of public sector involvement with disinvestment of PSUs, abolition of licensing except for 18 industries and Restrictive Trade Practices Act and relaxation of Monopolies The Privatization increased competition and efficiency with introduction of Competition Act, 2000. The Globalization helped in expedited knowledge transfer and technology upgradation by allowing domestic markets to import efficient technology and foreign direct investment from 51%% to 100% limit in selected sectors. Later, export oriented policies were also introduced such as Special Economic Zones, Manufacturing Zones etcetera.

The current New Industrial Policy plans to achieve 'One Nation One Standard', promoting startups in every district and innovation zones. The Manufacturing Sector contributed an employment growth rate of 12% in 2014 which has a multiplier effect in overall aggregate demand. The 'Make in India' launched in 2014 had pillars like robust demand, high investment returns, making India attractive for FDI and Fil by easier route of investment. "The government planned to increase the share of Indian Manufacturing Sector to the Gross Value Added by 25% and create hundred-million more employment" [CII, 2023]. However, the sector only showed a share of 14.4%. In 2022, 'Make in India for the World' helps in boosting the finance access to startups for expedited growth, integration of global value chains and improved employment and skill [DPIIT, 2022]. The Economic Survey of India shows new investments in this sector in 2023 financial year which will be almost 5 times than the allocations made in 2020. The Industry 4.0 technical upgradation is also part of government's plan to boost economic environment.

Despite several attempts in improvement of Industrial Policies, Indian Manufacturing Sector has a low share of GDP in comparison to other middle-income nations. The Labour and Capital Productivity is one factor which has not been capitalized in the nation with 2nd largest population of the world. Productivity is a measure of output and input fractions and if compared within time series data it provides an overall picture of economic growth in past 20 years [Marelli and Signorelli, 2010]. The purpose of this paper is to analyse the growth rate of the manufacturing sector, the performance gap between government plans and actual results, and Total Factor Productivity from 1980 to 2020. These 40 years depicts several business cycles of recession and boom and 2 years of COVID-19. It is imperative to study these factors to understand the trend of productivity and growth of manufacturing sector and predict the roadmap ahead to focus on the pitfalls to meet the plan of the government to increase the share of Manufacturing Sector to 20% by 2025, next 2 years [DPIIT, 2022].

2. Literature Review

The study of productivity is vital for improvement in overall Manufaturing Sector both at the domestic level and at the international level. The profit maximization theories also stress upon two ways of increasing profit in any type of market is either through increasing output

or decreasing cost. For effective utilization the growth has to productivity driven [Sehgaland Suparn, 2011]. Though productivity driven growth doesn't necessarily reuire input growth however, within Indian economy tapping on that demographic dividend as well will give a mutiplier effect. With globalization, we require more ways of know in terms of upgradation of technology, structural changes within organized factories, skill upgradation and capital accumulation [Krugman 1994]. There are several factors affecting the producitiviy namely, K-Capital Stock, L-Human Resource, M- Material, T-Technology [Leong 2000]. "The way ahead for the Indian Government to increase share of manufacturing sector in overall Gross Domestic Product is through productivity to pave way of competitiveness, quality of product and efficient pricing". The study of productivity is spread across several generations. From the period of 1950's few early studies of [Reddy & Rao 1962] to the study of [Ahluwalia, 1986], all stress of the estimation of Total Factor Productivity to study the growth of India's Manufacturing Sector providing similar results. With the introduction of New Industrial Policy in 1991, sveral studies were performed to examine the effect on productivity and value added growth rate such as [Balakrishnan & Pushpangadan 1994] depicting the increased and applaudable growth in India's Manufacturing Sector with use of double-deflator in the value-added production function. The affect of government industrial policy and reforms within the trade policies after the 1991 led to several studies using Total Factor productivity to look at the overall growth achieved. Contrary to this, in a study conducted by [Trivedi 2011] the TFP was at 1.88% in 10 years period from 1980's to 90's and had fallen to 1.05% from 1992 to 2007's.

Productivity of factor inputs is a major determinant of economic growth. All factors such as material, technology, labour and physical capital are required to improve. Similarly, a research by [Ismail et al 2009], the pattern of productivity in the organized sector is studied to provide picture of India's regional performance in the manufacturing sector. A study in the pharmaceutical sector was conducted to identify the bottle necks and it was concluded that low productivity is causing low production [Phusavat 2006]. A study was conducted to examine the labour productivity of Canada's la our force using time series data developing an econometric model to establish relation between labour productivity and research & development. The involvement of capital stock has a vital role to play in overall economic growth as well [Khazabi 2008]. In 2011, another study was conducted to formulate an approach to measure performance at industry level. The study shows how strategic and operational targets can also bring about a change in overall performance [Akyuz 2011]. The labour productivity is also influenced by the knowledge available which further provides on-job satisfaction and stability in the organized sector as per study conducted [Noruzy 2011]. Another study conducted in 2011 developed a methodology to bring competency in the labour workforce and effectiveness in production [Razak 2011]. The analysis of business strategies can also help get ideas for labour productivity as per the paper given by [Phusavat et al 2012]. The study shows that factors such time put in by labours reduces the effectiveness and affects the overall production supported by the theory of diminishing returns [Shepard & Clifton 2000]. There have been several studies performed in agricultural sector, manufacturing sector and service sector within India to study productivity and expansion of growth. The Indian government has come up with several initiatives to boost growth in the manufacturing sector. This research papers aims to study the trends of gross value added, labour productivity and total factor productivity from 1980 till 2021 covering all periods of

global recessions and relate them to the initiatives made by the Indian Government. Further, trend is also studied for 27 industries to identify the dying industries with potential to grow.

3. Data Collection

Productivity growth, also known as the Total Factor Productivity Growth Rate, is defined as the ratio of output to the sum of input indices. It benefits all four players - the employee, employer, consumer and government. The researches published in the past on productivity and growth from manufacturing sector to the agricultural sector to the service sector and economy aggregates. This study utilizes the KLEMS database and ASI (Annual Survey of Industries) database to measure the labour productivity, employment and capital formation. The KLEMS database considers the international approach to build the data series covering 27 industries and several factors such as capital, , machine, labour, material, energy and services. The Annual Survey of India published by CSO (Central Statistical Organization). It only considers the organized sector with 23 sub sectors as per the 2-digit NIC classification. The study uses following variables of study:

- **Gross Value-Added Growth Rate:** It is the value of total output minus the value addition at the intermediary level. KELMS database utilizes this data from NAS for several industries for both organized and unorganized sector. The organized sector data is collected by ASI database and unorganized data is taken from NSSO survey till the seventy third round in 2015-16.
- **Labour force:** Either the total number of workers or the total number of hours worked can be used to measure it. However, it is extremely difficult to rely on data of total hours worked in a developing country like India with both organized and unorganized sector, so total number of workers is the measure use to calculate the labour force.
- **Capital Stock:** KLEMS database uses capital services to production to estimate this measure using productivity estimation approach by [Jorgenson & Griliches 1967]. The difference lies in the type of assets and vintages approach. The Capital Stock measure the heterogeneity of different vintages and KLEMS method also includes heterogeneity in the type of assets while calculating the depreciation rate.
- **Labour Income Share:** Income share of labour is a measure of growth in total output contributed by labour force. It is the ratio of labour emoluments to gross value added. The elasticity of labour in total factor productivity under the assumption of competitive market can be measured using the labour income share [Bulent 2003]. Further, under competitive markets the factors of production are compensated as per the marginal social product so the concept of constant returns to scale is implied causing the summation of the elasticities of all inputs to be equal to one if we assume constant returns to scale.
- **Capital Income Share:** The capital income share is used to measure the elasticity of capital as explained in the above point. Under the assumption of only two factors of production, it should be equal to 1 minus the labour income share.
- **Labour Productivity.** This is the measurement of real gross value produced by each labour input. So, this has a direct effect on overall total factor productivity. It can be measured by dividing the real gross value added by total labour force employed.

- **Total Factor Productivity:** It is the index of gross value added or the output fractioned to the composite index of all factors of production. The KLEMS database has measured total factor productivity by taking into consideration 5 factors of production namely, K-Capital, E- Energy, M-Material, L-Labour and S- Services within twenty-seven sectors of the Indian economy.

4. Data Methodology

The paper has used two databases to show the trends of gross value added, labour income share, employment and labour productivity in organized sector and aggregate economy. The organized sector is depicted using ASI data and aggregate economy is covered using KLEMS database.

ASI provides the data of net value added for the industries and depreciation in the Annual Series for Principal Characteristics. 2019-2020. We have measured gross value added by summation of net value added and depreciation. The workforce comprises all individuals actively involved in employment. The proportion of labor income is determined by dividing overall earnings by the total gross value added. Similarly, akin to the gross value added calculation, gross fixed capital formation results from the summation of net fixed capital formation and depreciation. Labor productivity is gauged as the ratio between gross value added and the total number of individuals engaged in work. All the variables are calculated in growth rates, so the period of study is constructed from 1981.

The KLEMS database uses aggregate indicator to construct the input series. The time series data is divided on the basis of Indian government initiatives towards industrial policies. The period covers first the trend of 1980-2000 and 2000-2020. The first trend mostly covers the industrial resolution of 1985 to the liberalization, privatization and globalization policy of 90's and the second trend covers the new industrial policy effects and current reforms. Both the periods additionally cover the financial cirisis along with the changes observed in the government policies and reasons for the fluctuations. KLEMS database covers 13 industries under manufacturing sector namely, beverages, Food products & tabacco products; textile products leather, Textiles, & footwear; products of wood & Wood; Pulp, paper, nuclear fuel & paper products; Chemicals & chemical products; rubber & plastic productts; Other non-metallic mineral products; Basic metals & fabricated metal products; machinery, electrical equipments; Transport equipment and recycling. The KLEMS production function used to measure labour productivity and total factor productivity in below equation 4.1. uses a value added method:

$$V_{j,t} = f\left(K_{j,t}L_{j,t}A_{j,t}^{v}\right) \quad \text{.....4.1}$$

where, L = Labour, V = real value added, A = efficiency or Total Factor Productivity (TFP), K = Capital and, t = time and j = all industry. Value added production function is used as it relates to technology explicitly [OECD 2001]. However, value added can give biased results as thee is value added at all intermediary levels and possible technology upgradation as each level as well. So, the paper preferred to use the gross output rather than gross value added while calculating TFP. The gross-output production function is given below in equation 4.2.:

$$Y_{j,t} = f\left(K_{j,t}L_{j,t}E_{j,t}M_{j,t}S_{j,t}A_{j,t}^{y}\right) \quad \text{.....4.2.}$$

"where Y is real gross output, E, M, and S are real intermediate inputs, respectively energy, materials, and services inputs". The value added or the real gross output can be rewritten in terms of the inputs. So, this means that output of industry can also be input for another industry if these are at intermediate level. So, by this logic it is appropriate to use value added function. Further, if we move he perspective in a wider sense labour and capital can be considered inclusive of age, experience, skills etc. and machines, laptops, fixed assets etc. respectively, Perhaps, K and L can be considered as only to factors of production and equation 4.1. can be rewritten under the assumption of competitive markets by replacing the share of inputs by the compensation of inputs. Refer to the equation 4.3. below:

$$\Delta lnV_{j,t} = \Delta lnA^{v}_{j,t} + \bar{v^{v}_{K,j,t}}\Delta lnK_{j,t} + \bar{v^{v}_{L,j,t}}\Delta lnL_{j,t} \quad \text{4.3.}$$

where A with respect to v = TFP, v = value added, A In = growth rate with respect to K/L, value added with respect to K / L = Compensation of inputs/share. With the assumption of constant returns to scale, the summation of value added by K & L will be equal to 1. So, equation 4.3. can rewritten with respect to value added of input for deduction:

$$V^{v}_{L,j,t} = \frac{P^{L}_{j,t}\cdot H_{j,t}}{P^{v}_{j,t}\cdot V_{j,t}} \quad \text{4.4.}$$

where P with respect to L/v=Compensation of labour/value added and H = labour hours.

Similarly, the labour productivity function is estimated using the Tornqvist index of labour hours by labour as shown in below equation 4.5.:

$$\Delta lnL_{j,t} = \sum \bar{v_{l,J,t}}\,\Delta lnH_{l,j,t} \quad \text{4.5.}$$

where A In L = Total labour force, ▲ In H = growth rate in labour hours, I = type of labour, j = type of industry and v = share of labour type I in industry j within the total labour force L. The labour productivity for each labour depends on several variables such as education level of the labour, the years of experience and skill set. Education data may still be possible to collect however, information regarding earning levels, skill set and years experience is subjective and may also not be known to all. As shown in the equation 4.4. if we rearrange the above equation with respect to growth rate in terms of quality and quantity it shows how this index measures the level of education groups within the labour force.

$$V^{v}_{L,j,t} = \frac{P^{L}_{l,j,t}\cdot H_{l,j,t}}{\sum P^{L}_{l,j,t}\cdot H_{l,j,t}} \quad \text{4.6.}$$

Productivity can then be measured by considering compensation of labour as the marginal productivity times the labour force. This is a concept of neoclassical school of thought that all labour force is compensated as per their marginal productivity which is the marginal cost. And, marginal cost is equal to marginal revenue, so if productivity of a labour is higher, he/she will contribute higher (increase marginal revenue) and will be paid higher as well (increase in marginal cost).

5. Data Analysis

The growth rate of the Manufacturing Sector from 1980's to 1990's and from 2001 to 2020 in the below Figure 1 and Figure 2 respectively shows the clear effects of the New Industrial Policy.

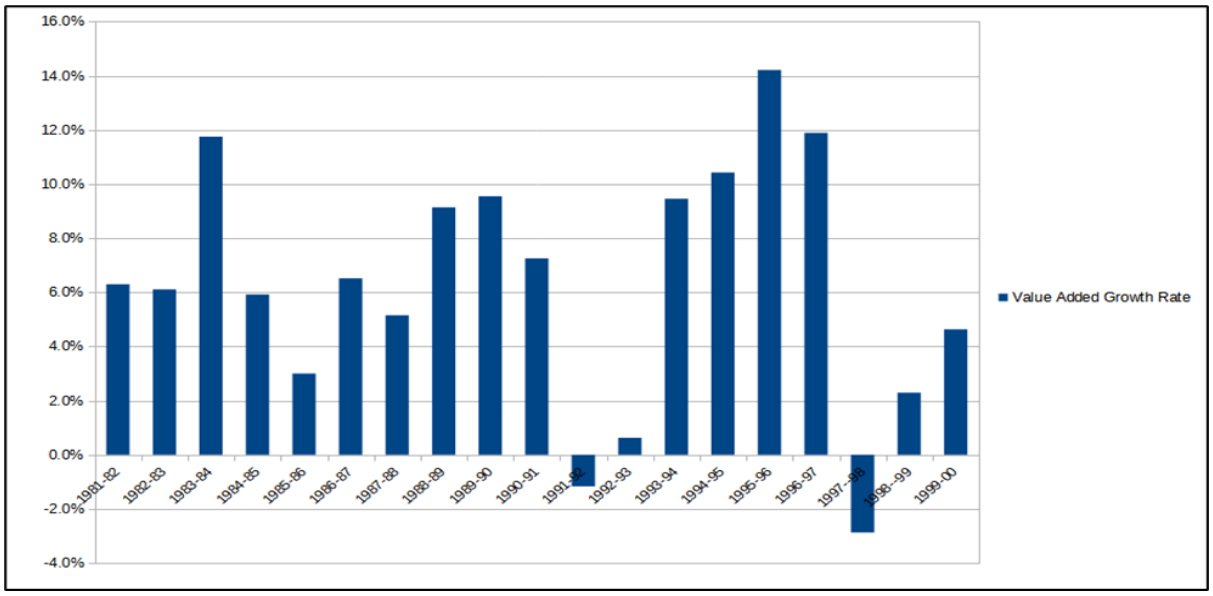

Figure 1: Growth Rate of India's Manufacturing Sector (1981-82 to 1999-00)-Organized and Unorganized Sector

Source: INDIA KLEMS Database 2021

In the 1981-82, Manufacturing sector witnessed a value added growth rate of 6.3% as the strategies mainly focussed on large and heavy industries with control on public sector. However, with the introduction of Industrial Resolution of 1985-86, we can see an increased rate of 11% to 9.1%. This policy focussed on opening the domestic markets by relaxation in the foreign investments allowing transfer of technology, relaxation of industrial licensing in selected sectors and efficient functioning of Public Sector Units. Even with this growth rate, performance of Public Sector Units was extremely poor, the government had to take international debts and along with it came the Gulf Crisis and liquidity Crisis for India [Kumar, 2014]. The declining and negative growth rate in the 1991 to 93 depicts India's economic condition with 8.5% fiscal deficit of the GDP, plummeted for-ex reserves and 16.7% inflation rate. So, the Indian government was forced to adopt the New Industrial Policy of 1991 which led to the abolition of License Raj, dismantling of price controls, privatization is selected sectors, increased foreign investment and overall economic growth depicted with 9.5% to 14.2% value added growth rate. The negative growth rate in 1997-98 is majorly due to the international financial crisis, slowdown of global trade and global deflation. The economy recovered a little with 2.3% and 4.6% value added growth rate in 1998-2000 due to East Asian Crisis, low global imports and spurted inflate rate to 8.8% [Economic Survey, 1998-99]. The employment in the manufacturing sector grew slowly and labour income share declined nearing 1997-2000s.

The value added growth rate of "India's Manufacturing Sector" from the period of 2000-01 to 2019-2020 for the aggregate economy is shown in Figure 2.

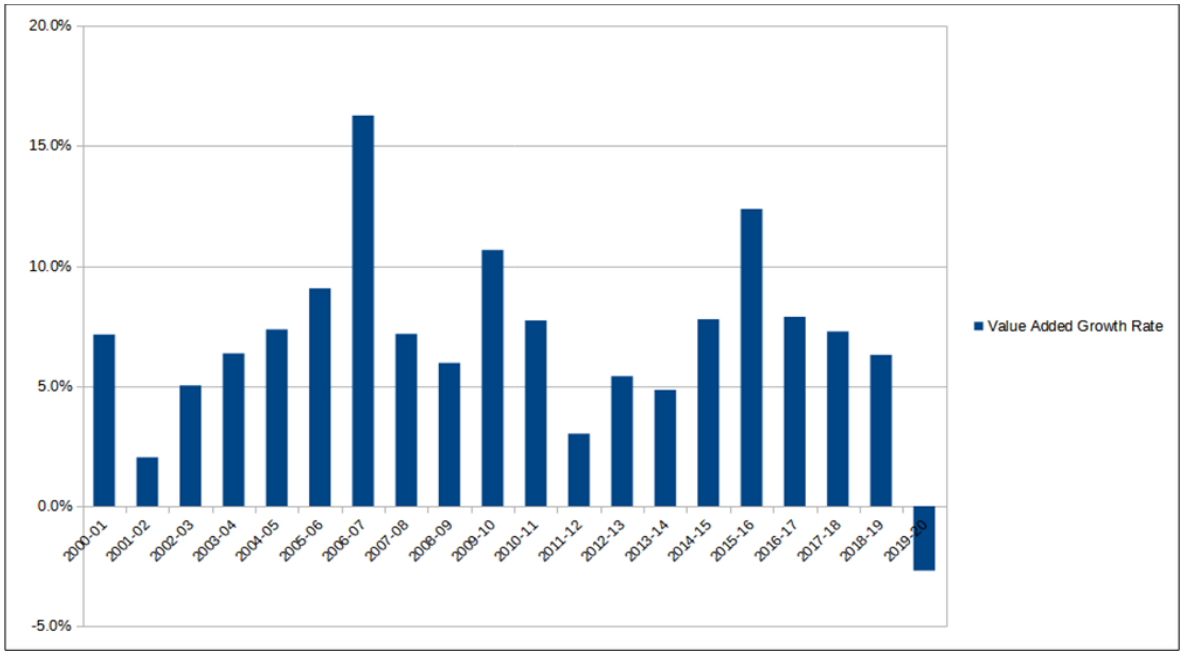

Figure 2: Growth Rate of India's Manufacturing Sector (2000-01 to 2019-2020) - Organized and Unorganized Sector

Source: INDIA KLEMS Database 2021

Overall, the period of 1997 to 2007 has witnessed a complete turnaround from economic slowdown to surging value added growth rate of 16.3%. There was sharp increase in gross fixed capital formation from negative to in 2002-03 to a 67.54% in 2005-06. This was focussed majorly to auto-mobile sector, metals and machinery. With the onset of global economic crisis, the period after 2006-07 shows decline and stagnant value added growth of manufacturing sector at an average of 6.6% until 2015-16 in the organized sector. The period of 1997 to 2007 has witnessed a complete turnaround from economic slowdown to surging value added growth rate of 16.3%. There was sharp increase in gross fixed capital formation from negative to in 2002-03 to a 67.54% in 2005-06. Appreciation of INR caused fall in Indian Exports especially India's textile industry. There was also a shortage of power causing productivity to decline and production only at 50% capacity [JJ Thomas, 2013]. The apparent negative value added growth rate of -2.7% is due to COVID - 19 lockdown. The manufacturing sector's current contribution of GDP is 14.4%, and it is projected to rise by double digits between 2021 and 2022.

However, if we zoom in to the looking glass and only look into the organized sector of the Indian Economy, we can see the value added growth rate in the below Figure 3 and Figure 4 from 1980's - 90's and from 2001-2020 respectively.

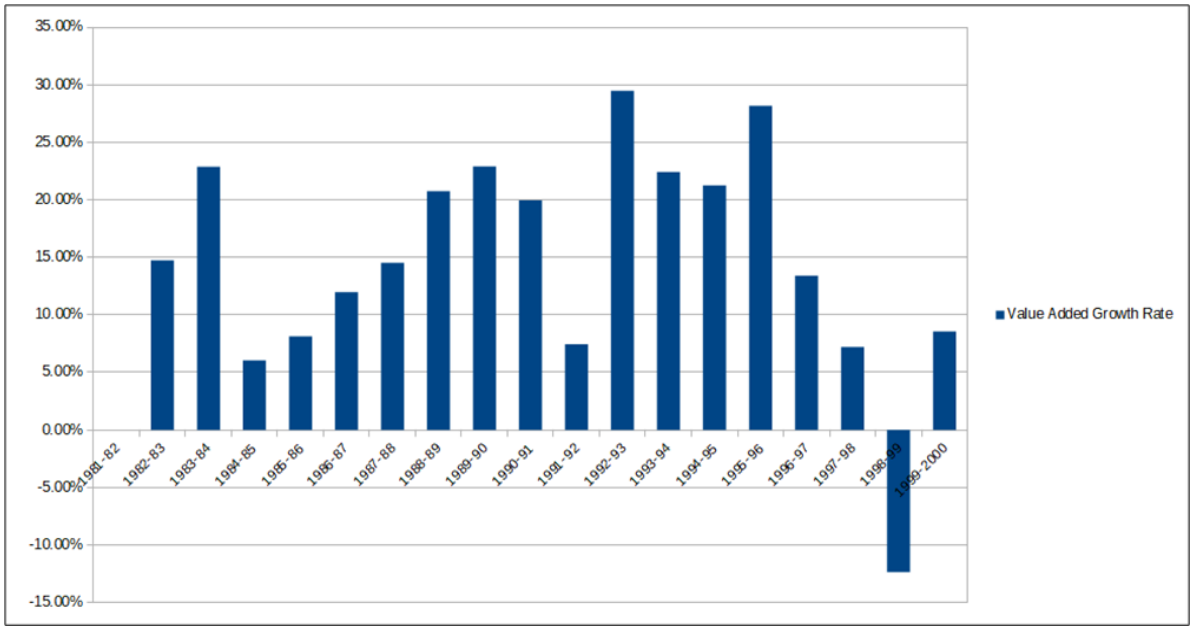

Figure 3.: Growth Rate of India's Manufacturing Sector (1981-82 to 1999-00)-Organized Sector

Source: ASI 2019-2020 Data and Author's calculations

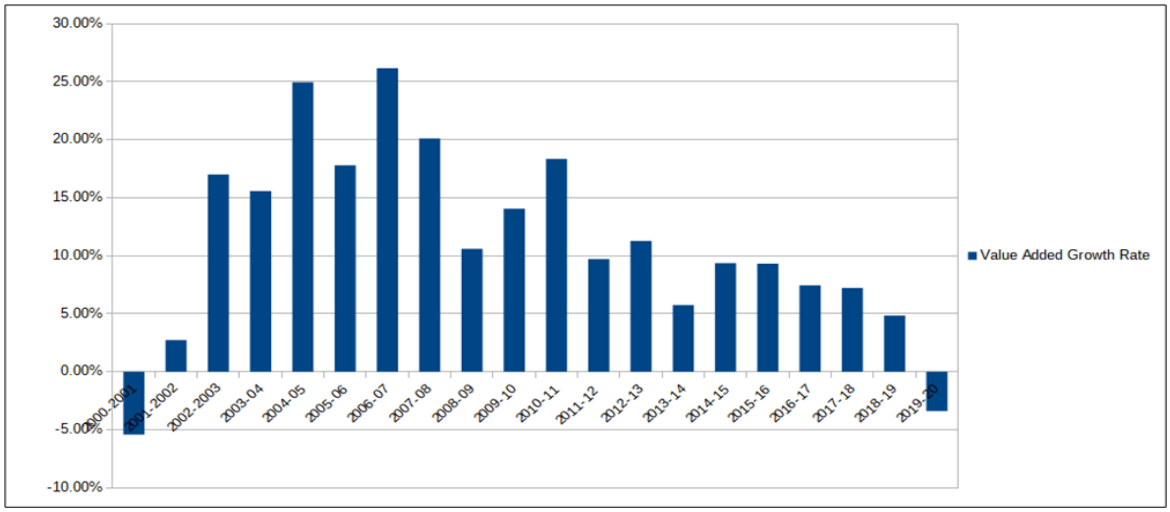

Figure 4: Growth Rate of India's Manufacturing Sector (2000-01 to 2019-2020)-Organized Sector

Source: ASI 2019-2020 Data and Author's calculations

The trend of growth rate in the registered / organized manufacturing sector is not substantially different from the trend of aggregate economy growth rate. However, difference can be observed with the maximum growth rate reaching 29.48% in 1992-93 in the organized sector where as for the aggregate economy the growth is much lower. This shows that though 90's new industrial policies had a huge impact on escalated growth rate of the registered sector, the unregistered sectors grew at a very slow rate. On the contrary, the impact of global

financial crisis can be seen to have much larger effect of registered or organized sector with negative growth rate of approx. 12% in 1998-99 and negative 5.42% in 2000-01 where as it was milder on the aggregate economy with positive growth rate of above 5% in 2000-01.

One of the major objectives of the Indian government has been to increase employment with job creation, labour laws and structure of the labour market. Post the new industrial policy, the growth of employment is slow and still faces several challenges (ILO 2014]. The below Figure 5 shows the trend of employment in the "Manufacturing Sector of the Indian Economy" from the period of 1980's to 90's and 2000-2020.

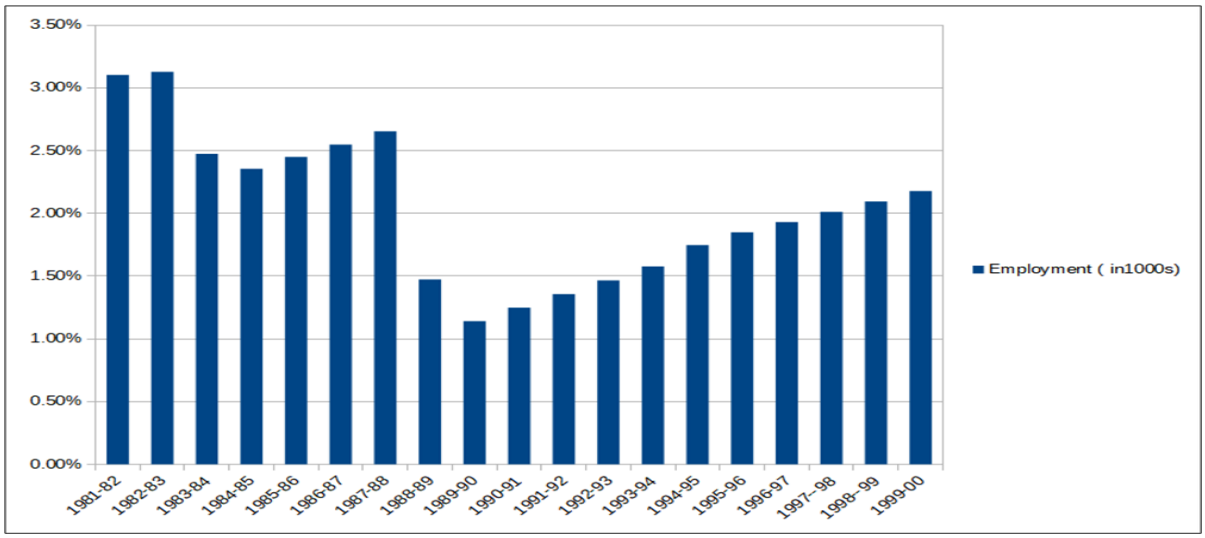

Figure 5: Employment Growth Rate in Manufacturing Sector of India (1981-2000)

Source: INDIA KLEMS Database 2021 and Author's own calculations

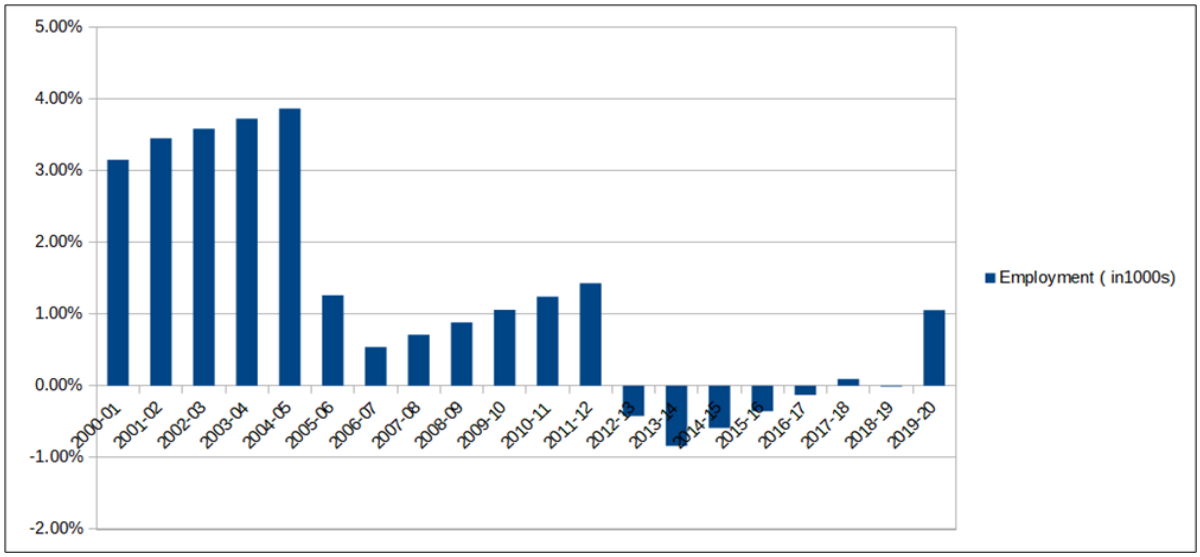

Figure 6: Employment Growth Rate in Manufacturing Sector of India (2000-2020)

Source: INDIA KLEMS Database 2021 and Author's own calculations

As the manufacturing sector's gross value added has increased, employment has grown at a far slower rate. Employment increased by only 0.54% in 2006-07, despite a 16.39% increase in GDP. In the latter years, the chart depicts negative growth rate in employment from 2012-2019. Employment is dependent on several factors [Nagaraj 2020jsuch as fall in the savings rate, gross capital formation, economic slowdown globally causing fall in the exports and higher inflation due to higher oil prices. If we look at the organized sector of the Industries, then the employment growth rate was much higher at 2.72% in comparison to 0.46% in the unorganized sector [Krishna et al. 2022]. The trend of employment in the Manufacturing sector can be seen more closely within it's sub sectors to identify the industries which witnessed least amount of spur. Th below Table 1 shows the decadal growth of employment within 13 sub-sectors.

Table 1: Decadal growth of employment in Manufacturing 13 sub sectors (1981-2020, log changes)

Sub Sectors	1981-1990	1990-2000	2000-2010	2010-2020
Beverages, Food Products and Tobacco	23.37	26.72	6.93	15.70
Textile Products, Textiles, Leather and Footwear	14.96	-2.98	18.42	15.54
Wood and Products of wood	14.68	44.04	-8.66	24.37
Paper products, Pulp, Printing, Paper, and Publishing	33.76	31.29	19.46	-16.09
Refined Petroleum Products, Coke and Nuclear fuel	98.26	15.84	25.59	-83.86
Chemicals and Chemical Products	38.01	23.43	8.55	-32.93
Rubber and Plastic Products	78.87	53.95	40.75	-26.15
Other Non-Metallic Mineral Products	17.41	10.11	34.74	14.26
Basic Metals and Fabricated Metal Products	28.87	29.79	21.47	-18.52
Machinery, nec.	6.60	91.14	35.89	-71.64
Electrical and Optical Equipment	58.69	32.04	84.01	-75.49
Transport Equipment	48.58	24.10	43.09	-39.92
Manufacturing, nec; recycling	53.94	8.04	64.58	-0.26

Source: INDIA KLEMS Database 2021 and Author's own calculations

Within the thirteen Manufacturing sub sectors studied in the KLEMS research, it is evident that very few industries experienced growth in employment. Industries that experienced maximum growth rate from 1980-90 are Coke, Refined Petroleum Products and Nuclear Fuel, Rubber and Plastic Products, Electrical and Optical Equipment, and Transport Equipment. From the period of 1991-2000, Machinery, Rubber and Plastic products, Wood and products of wood, and Electrical and Optical Equipment. From the period of 2000-10, Electrical and Optical Equipment, Transport Equipment, Rubber and Plastic products, and Machinery. From the period of 2010-20, Wood and products of wood, Textile, leather Products, Food products and Other Non-Metallic Mineral industry witnessed increase in employment. Overall, Electrical and Optical Equipment, Machinery, Rubber and plastic products and coke & refined petroleum products only experienced fastest growth in employment. On the contrary, industries like textile, leather products, food products, Non-Metallic Mineral and Chemical industry experienced least growth in employment. Further, in the last decade from 2010-2020, most industries experienced negative growth rate of employment. Though this portrays an alarming picture, but if we look at an aggregate economy then unemployment rate has reduced and not been as high as fall in employment. This is because of other factors such improvement in skill set, literacy rate, unorganized sector where workers engagement is not recorded, or entrepreneurs who are self employed [Rodgers 2020].

The Labour income share is one of variables used as weights to define the labour share in total productivity as discussed in Methodology. It also explains the distribution of national income as labour income share is to the gross value added of a nation. If there is a fall in the labour income share, it implies income share has increased within other factors of production, K= Capital in our study. Hence, unequal distribution. Further, labour income share inversely affects the labour productivity. So, if the real output price rises faster than labour productivity, labour income share rises. If we closely observe the changes in the overall share of primary, secondary and tertiary sector in the nation's GDP, it is quite evident from literature that there has been a structural transformation from primary to tertiary sector and skipping the secondary sector [Kochhar 2006]. The share of agricultural sector had decreased to 17.9% in 2017-18 from 38% in the 90's. On the contrary, share of services sector has increased from 54% in 2017-18 from 37% in the 90s. There has been no substantial change in manufacturing sector with only less than 4% increase. Simultaneously, this shift can be observed in labour productivity as well. Labour productivity depicts economic growth, economies competitiveness and living standard of the population as per the [OECD 2008). If an economy has productive labour it directly affects the cost of production and thus, competitiveness at the global level. With better quality products and competitiveness, the participation increases in the global value chains [Dieppe 2020]. The below Table 2 shows the decadal trend of labour productivity within the manufacturing sector from 1980's to 2020.

Table 2: Labour Productivity in Manufacturing Sector of india (1981-82 to 2019-20, log changes)

Sub Sectors	1980-1990	1990-2000	2000-2010	2010-2020
Food Products, Beverages and Tobacco	98.13	34.44	85.83	105.63
Textiles, Textile Products, Leather and Footwear	26.82	58.14	67.99	129.85
Wood and Products of wood	-30.31	-39.70	8.82	148.44
Paper products, Pulp, Printing, Paper, and Publishing	56.41	-20.51	86.48	18.98
Refined Petroleum Products, Coke and Nuclear fuel	101.85	15.92	49.79	-36.83
Chemicals and Chemical Products	79.07	77.09	56.14	22.76
Rubber and Plastic Products	34.95	40.43	6.88	29.51
Other Non-Metallic Mineral Products	126.46	57.05	23.45	107.00
Basic Metals and Fabricated Metal Products	15.34	26.60	63.76	14.67
Machinery, nec.	86.72	-20.95	85.52	-8.88
Electrical and Optical Equipment	75.88	19.35	118.68	-6.08
Transport Equipment	20.95	49.56	93.41	58.36
Manufacturing, nec; recycling	-6.16	143.47	29.30	118.86

Source: INDIA KLEMS Database 2021 and Author's own calculations

The growth of labour productivity depicts the growth of gross value added for each industry with respect to the number of people engaged. Sub-sectors such as Machinery shows huge fluctuations from positive to negative growth rate of labour productivity followed by sectors such as wood and wood products, paper industry and basic metals and fabricated metais products. On the contrary, industries like food products, textile industry, other non-metallic industry, and manufacturing, recycling experienced increased labour productivity. If we divide the industries in capital/labour intensive, it can be seen that food products and non-metallic industry are low-capital intensive industry, textile industry and manufacturing recycling industries are labour intensive industries. So, major increase in labour productivity can be witnessed in either low capital intensive industry or labour intensive industries. Whereas, Machinery, wood products, paper and basic metals industry are low capital intensive industries. In the first decade, high capital intensive industries seems to have grown the fastest such as Coke, refined petroleum products and nuclear fuel and Chemical industry. In latter decades, the more labour intensive industries witnessed faster growth rate. However,

the labour productivity has not followed a constant trend, we can see decadal fluctuations from positive to negative growth rate. The below figure 7 & 8 shows the aggregate trends of labour productivity in the broader sectors from 1980-81 to 2019-2020.

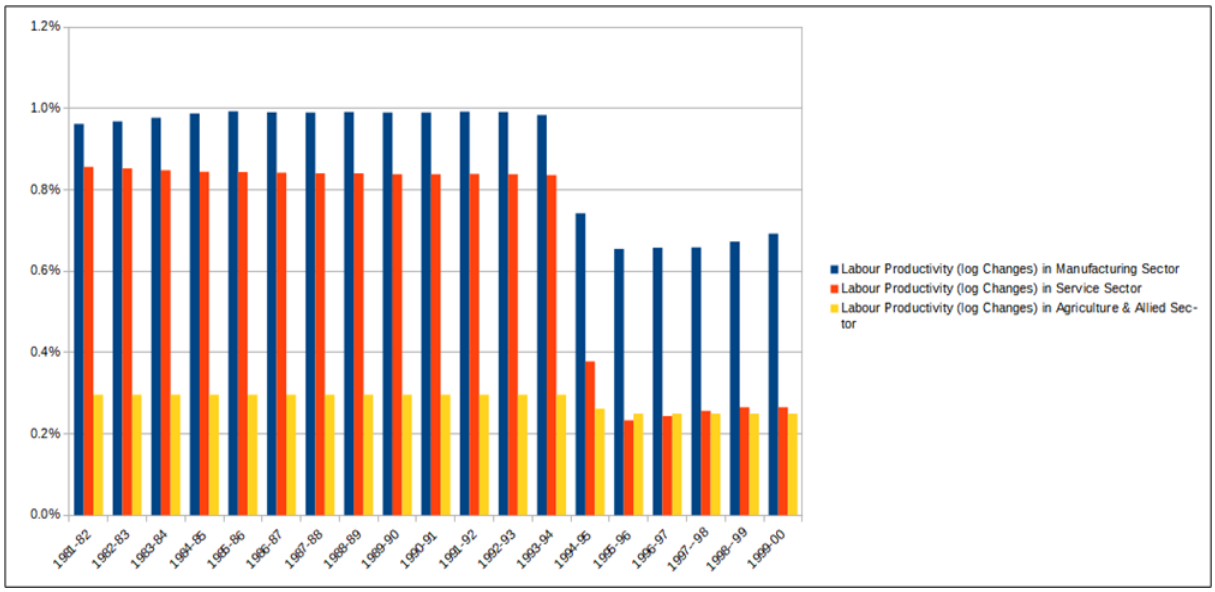

Figure 7: Labour Productivity Growth in Broad Sectors of India (1980-81 to 1999-00)

Source: INDIA KLEMS Database 2021 and Author's own calculations

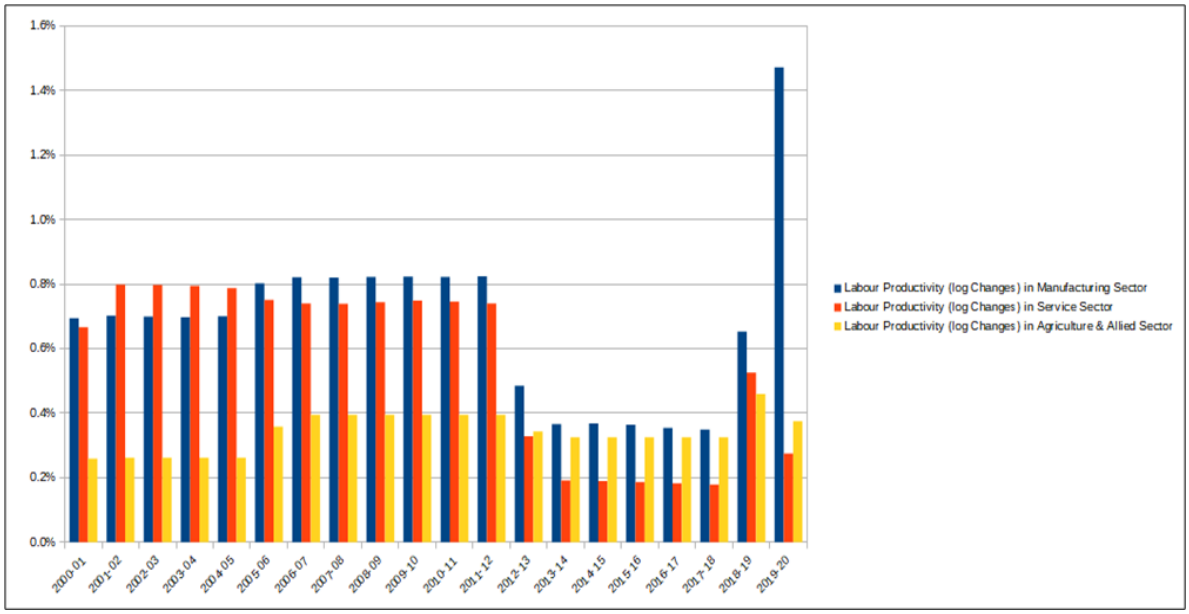

Figure 8: Labour Productivity in Broad Sectors of India (2000-01 to 2019-20)

Source: INDIA KLEMS Database 2021 and Author's own calculations

The above figures will help us to understand the structural changes in the Indian economy by looking at the productivity trends within all broad sectors of the economy. As the logic suggests labour follows the wages, higher the wage rate, higher the supply of labour. The wages are dependent on the labour productivity, it is higher in more productive sectors. So, by this logic labour shifts must be witnessed from lowest productivity sector-agriculture, to manufacturing sector followed by the service sector with higher productivity. The labour productivity evidently has increased in all sectors, however, the growth is agriculture & allied sectors is the least and the highest in manufacturing sector. Figure 7 shows the trend of period of 80's and 90's when government policies were more focussed on heavy industry, self-reliant, control of public sector, so the growth is stagnant. However, post reforms upward trend can be see in Figure 8. Further, though manufacturing sector shows higher labour productivity, overall the value added growth rate and number of persons employed in this sector were lower.

After the reforms in the 1980's, the manufacturing sector growth rate had way surpassed the 'Hindu growth rate' depicted in Figure 1 and past the 1990's reforms which were focussed around efficiency and comprehensive growth, the manufacturing sector has witnessed even higher growth rate as shown in Figure 2. If the reforms are focussed on efficiency, then total factor productivity and capital stock per capita are great tools to measure economic welfare [Basu 2012]. These tools show valid results regardless of level of technology and type of market, so it can be a measure to compare economic welfare across nations as well It can also be utilized for open market economies if gross domestic product can be replaced by domestic absorption. Capital stock can be calculated by adding depreciation to the net fixed capital formation. The below Figure 9 shows the Capital stock for broad sectors and aggregate economy.

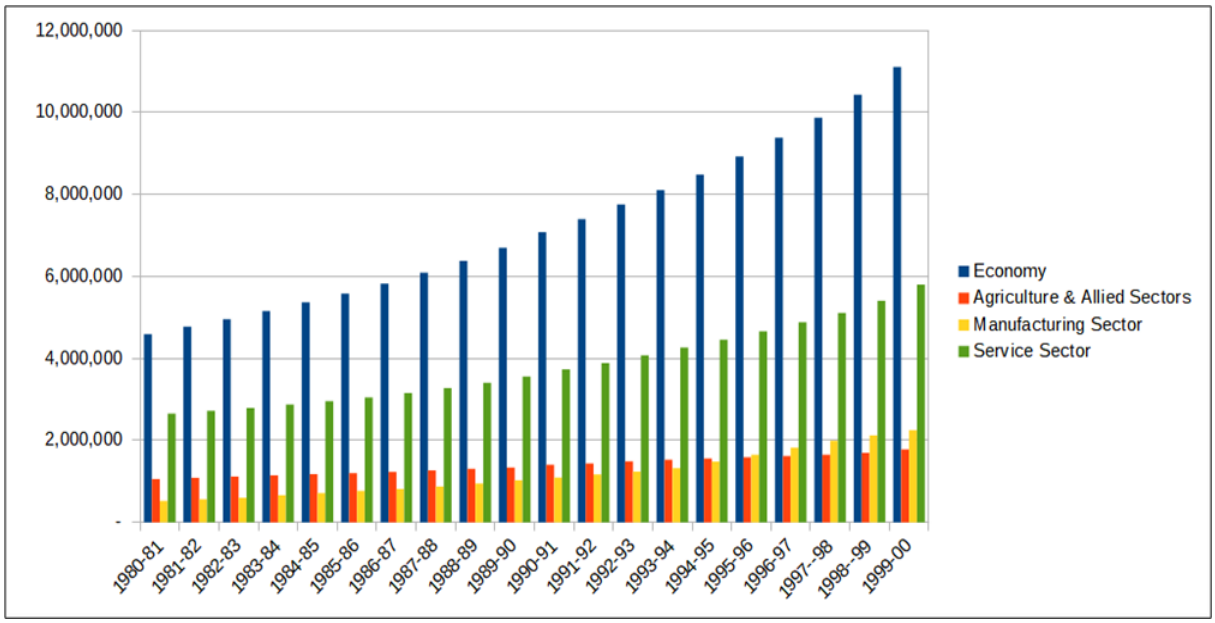

Figure 9: Capital Stock for broad sectors of Indian Economy (in Rs. crores at constant prices 2011-12, from 1980-81 to 1999-00)

Source: INDIA KLEMS Database 2021

In the beginning of the 1980's till 1994, we can see that agriculture & allied sectors are dominant over manufacturing sector in terms of capital stock whereas, within the services sector it has been constantly growing.

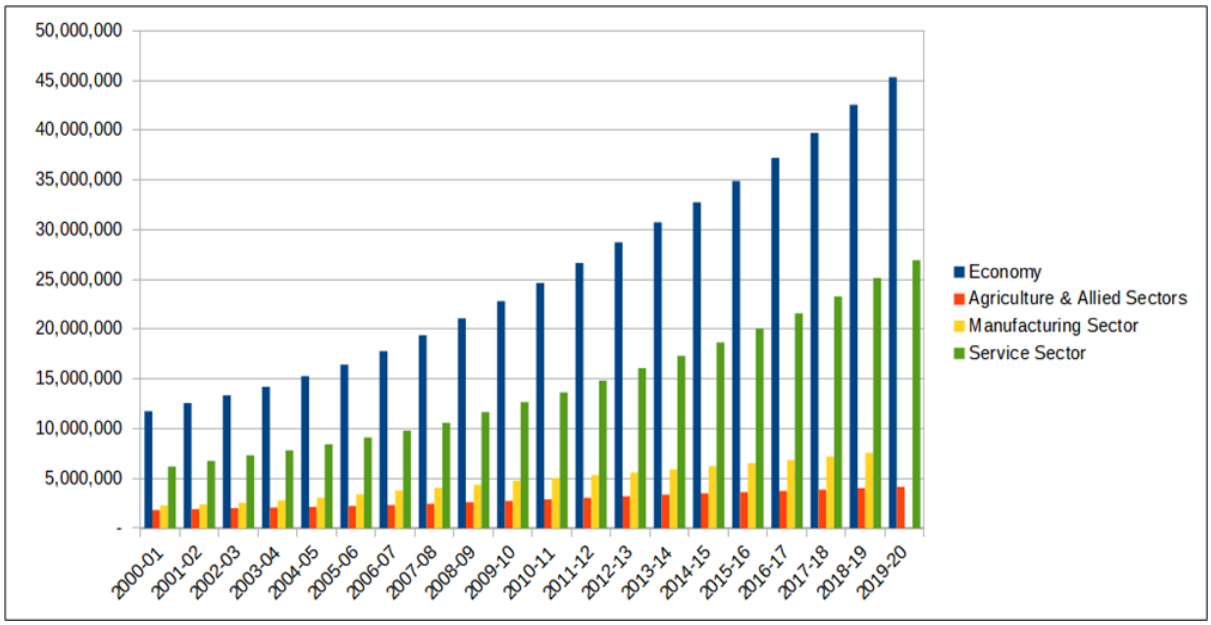

Figure 10: Capital Stock for broad sectors of Indian Economy (in Rs. crores at constant prices 2011-12, from 2000-01 to 2019-20)

Source: INDIA KLEMS Database 2021

Though we can witness an increase capital stock for all sectors by large margin and overall economy, the maximum increase in overall capital stock can be clearly seen in service sector. The overall capital stock on grew at an average of 4.77% from 1980-81 to 1999-00 for the aggregate economy followed by average growth rate of 7.29% from 2000-01 to 2019-20. While the growth rate in broader sectors like agriculture & allied sectors grew on an average of 2.76% in the first half and 4.38% in the latter half; manufacturing sector grew on an average of 89% in the first half and only 1.32% in the second half with almost 100% fall in 2019- 20 due to the COVID-19 pandemic, if we do not include the pandemic year then manufacturing sector grew at 6.65% in the latter half, services sector 4.22% from 1980-2000 and 7.98% from 2000-2020 including the pandemic year as no substantial fall was witnessed. This analysis is performed by the author and trend is depicted in the below Figure 11 skipping the 2019-20 COVID 19 pandemic year.

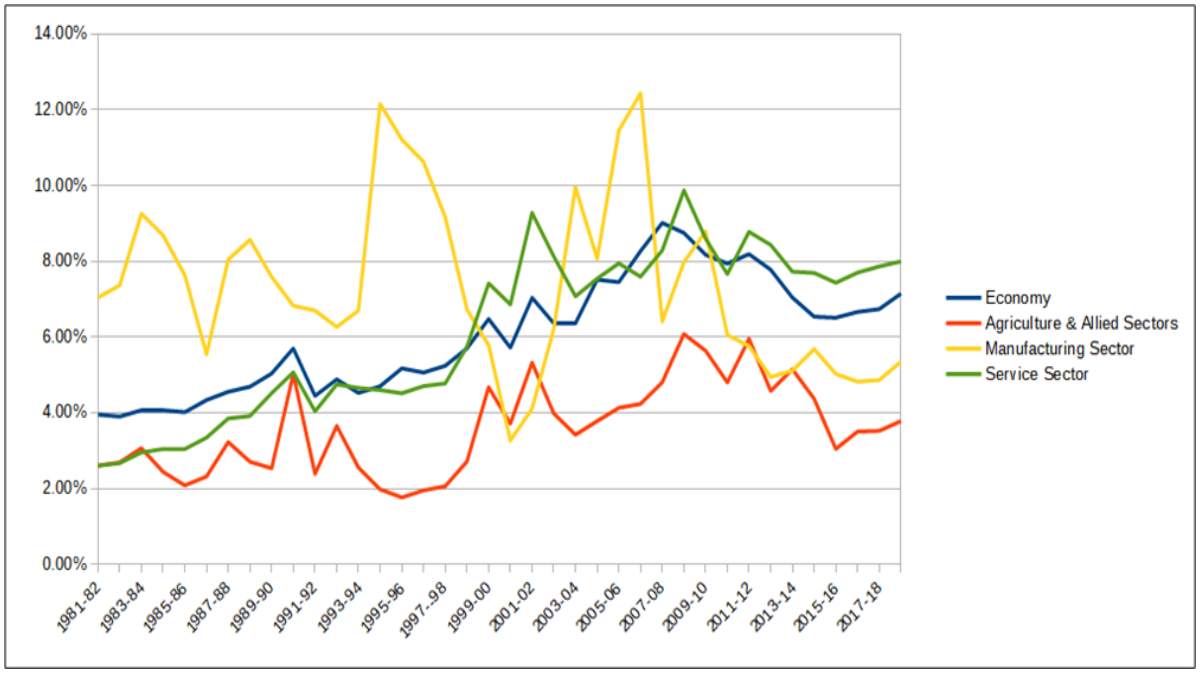

Figure 11: Capital Stock growth rate for broad sectors and aggregate economy (from 1981-82 to 2018-19)

Source: INDIA KLEMS Database 2021 and Author's own calculations

We will now further break the manufacturing sector to view the capital stock growth rate in each sub-sector of the manufacturing sector.

Table 3: Capital stock decadal growth rate in sub-sectors of the Indian manufacturing sector (log changes)

Sub-Sectors	1980-1990	1990-2000	2000-2010	2010-2020
Food Products, Beverages and Tobacco	66	62	59	49
Textiles, Textile Products, Leather and Footwear	83	99	79	35
Wood and Products of wood	60	71	58	13
Paper products, Pulp, Printing, Paper, and Publishing	109	21	23	2
Refined Petroleum Products, Coke and Nuclear fuel	191	121	90	109
Chemicals and Chemical Products	31	76	43	65
Rubber and Plastic Products	148	135	59	56
Other Non-Metallic Mineral Products	125	116	79	35
Basic Metals and Fabricated Metal Products	72	70	82	27
Machinery, nec.	95	79	90	64

Electrical and Optical Equipment	56	83	72	34
Transport Equipment	68	94	83	83
Manufacturing, nec; recycling	67	83	71	12

Source: INDIA KLEMS Database 2021 and Author's own calculations

Coke, refined Peroleum Products and Nuclear Fuel sector has grown the fastest in first decade followed by Rubber and Plastic Products, Other Non-Metallic Mineral Products and Pulp, Paper. Paper products, printing and pubishing. With Coke, refined Petroleum Products being a high-capital intensity industry and other 3 are low-capital intensity industries. Chemical and Chemical Products is another high-capital intensity industry with slow growth rate in capital stock in all four decades. A substantia fall can be seen in the growth rate for Pulp, paper and publishing, Rubber and Plastic products and other non-metallic minerals in latter two decades. Apart from these four sectors, some growth can also be witnessed in electrical and optical equipment and transport equipment only. Overall, there is a fall in the growth rate of capital stock from 2000's as shown in the aggregate sector Figure 11 with downward trend after 2006-07.

The below Figure 12 and 13 shows the total factor productivity for broad sectors and aggregate economy from 1981-82 to 1999-00 and from 2000-01 to 2019-20.

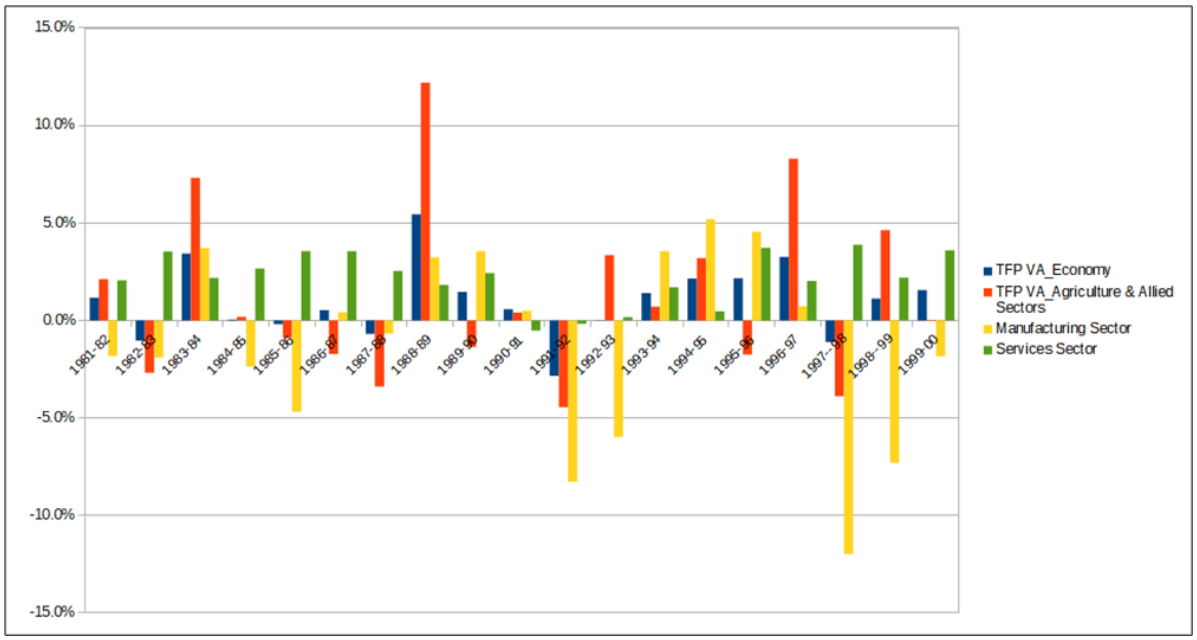

Figure 12: Total Factor Productivity Growth Rate for India's broad sectors (1981-82 to 1999-01, log changes)

Source: INDIA KLEMS Database 2021

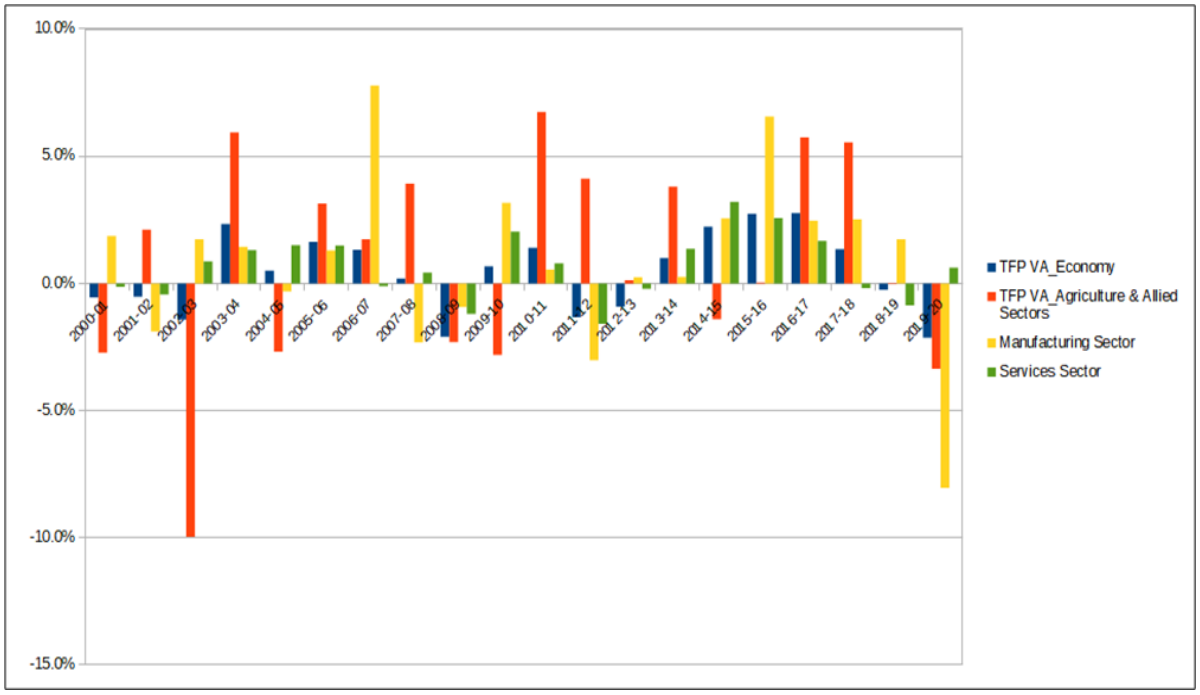

Figure 13: Total Factor Productivity Growth Rate for India's broad sectors (2000-01 to 2019-20, log changes

Source: INDIA KLEMS Database 2021

The total factor productivity (TFP) growth of aggregate economy on an average was 1% from 1981-82 to 1999-00 and 0.4% from 2000-01 to 2019-20 whereas, the value added growth rate in the former time period was 14.17% and 12.33% in the latter period. The TFP growth rate on an average was 1.29% from 1981- 82 to 1999-00 in agriculture and allied sector and 0.9% from 2000-01 to 2019-20. The above figure shows highest TFP in agriculture sector in 1988-89, 1992-93, 1996-99, 2003-08, 2010-12, 2013-14, 2017-18, so overall it is the highest performing sector where as the value added growth rate on an average was only 3.1% from 1981-82 to 2019-20. The TFP growth in manufacturing sector on an average was negative 1.196 with maximum drop of -8.3% in 1991-92 and -12% in 1997-98 and from the period 2000-01 to 2019-20, it grew at 0.9% with reaching the highest TFP growth rate of 6.6% in 2015-16 and 7.8% in 2006-07. If we remove the pademic COVID-19 year of 2019-20, average TFP growth rate was 1.49% whereas, the value added growth rate from 1981-82 to 1999-00 was 14.2% and 6.17% from 2000-01 to 2019-20. The TFP for services sector grew on an average of 2.2% and 0.7% from 2000-01 to 2019-20 where as, services sector value added growth rate was 16.02% in former period and 13.33% in the latter. Predominantly, the TFP growth rate contribution is the maximum from the services sector industry and least from the maufacturing sector. The table below shows the growth in total factor productivity of each sub-sector of the manufacturing sector to look more in-depth.

Table 4: TFP growth rate for sub-sectors of the manufacturing sector of India (1981-82 to 1999-00, 2001-2020 and 1981-2020)

Sub Sectors	1981-00	2000-20	1981-19	2020
Tobacco, Beverages and Food Products	-1.4	3.8	0.3	-8.3
Footwear, Textile Products, Textiles and Leather	-0.9	1.1	-1.9	-2.3
Wood and Products of wood	1.5	-4.6	-2.6	3.9
Paper products, Pulp, Printing, Paper, and Publishing	2.2	-1.4	-5.1	-2.4
Refined Petroleum Products, Coke and Nuclear fuel	-0.4	3.3	-0.1	-26.7
Chemical Products and Chemicals	-1.3	0.5	-0.6	-6.2
Plastic Products and Rubber	-1.1	-0.9	-1.0	-9.9
Other Non-Metallic Mineral Products	-10.1	-1.3	-2.1	0.3
Fabricated Metal Products and Basic Metals	10.7	-0.7	1.5	-1.2
Machinery, nec.	0.8	4.7	1.7	-17.9
Optical Equipment and Electrical	-4.9	-1.1	-1.5	-11.3
Transport Equipment	0.5	-2.2	-0.1	-14.9
Manufacturing, nec; recycling	-0.9	-1.2	0.7	-11.7

Source: INDIA KLEMS Database 2021 and author's own calculations

None of the industries can be categorized as the top contributers even though the value added growth rate witnessed by the industries was much higher. The 2007-08 is charaterized as the period of global economic slowdown followed COVID-19 pademic in 2019-20. Capital intensive industries such as refined petroleum products Coke and nuclear fuel, other non-metallic minerals, machinery, basic metals & metal products, witnessed an increase TFP growth rate.

6. Findings & Conclusions

Manufacturing sector is considered as one of key sectors contributing to the aggregate economic growth in several literatures across nations. In India, Manufacturing sector has achieved a share of 14.43% of the total Gross Value Added (2020-21) but the contribution towards employment, labour productivity, capital stock and TFP have been stagnant. In order to push the growth rate higher, the Indian government has come up several policies discussed in the paper such as 1980's, 90's and 2011-12 industrial policies, 2014 Make in india, relaunched as Make in India for the World in 2022 with focus towards inclusive growth, welfare of retail producers, ease of doing business in india and foreign investment. One of the major problem is the structure of the Manufacturing sector consisting of both formal and

informal sector which is dominated by the latter with almost 1/3 share of the gross value added of the economy and 2/3 share of the persons engaged. The labour productivity growth has been positive within the sub sectors such as, food products, textile industry, other non-metallic industry, and manufacturing, recycling and positive structural shift from less labour productive sectors to more productive ones. Employment has also increased in the formal manufacturing sector manifolds than the informal sector which argues the need to fully transforming the manufacturing sector into a formal sector. The capital stock has substantially been in a negative direction since the 1980's to 2020's. Coke, refined Peroleum Products and Nuclear Fuel sector has grown the fastest in first decade followed by Rubber and Plastic Products, Other Non-Metallic Mineral Products and Pulp, Paper. Paper products, printing and pubishing. Apart from these four sectors, some growth can also be witnessed in electrical and optical equipment and transport equipment only. So, another compelling argument is to focus policies towards capital stock and increase in the real wages by controlling inflation on necessities, promotion of MSMEs to promotes jobs. The Total Factor Productivity increase can be seen only in oke, refined petroleum products and nuclear fuel, other non-metallic minerals, machinery, basic metals & metal products, out of the 13 sub industries under Manufacturing sector. The paper can be utilized to focus on more policies focussing towards total factor productivity to increase competitiveness of the economy.

7. Challenges and Limitations

One of the major challenges faced in construction of time series data is the reliability of the data, availability of data from authentic sources, different methodologies for estimation and exclusive data on informal sector. The author further plans to study one of the sub-sectors within the manufacturing sector in further detail to give more specific policy improvement ideas in line with the above conclusions drawn. However, due to the limitation of time, it will carry forwarded in the next paper.

8. Bibliography

[1]. Isher Judge Ahluwalia.1986.Industrial Growth in India: Stagnation Since the Mid-sixties:.OUP India (13 February 1986):
[2]. CII, 2023: Confederation of Indian Industry, Manufacturing, 2023
[3]. DPIIT, 2022: , Scheme for Investment Promotion/Make in India,
[4]. Marelli and Signorelli, 2010: Marelli, E. and Signorelli, M., Employment, productivity and models of growth in the EU, 2010
[5]. Sehgaland Suparn, 2011: SehgalShallu, Suparn Sharma, Total factor productivity of manufacturing sector in India: a regional analysis for the state of Haryana, 2011
[6]. Englander, S and Gurney, A..OECD productivity growth: medium-term trends:.OECD Economics Studies:
[7]. Leong 2000: Chong, Chee Leong, Factors that determine productivity in the services sector, 2000
[8]. Reddy & Rao 1962: Reddy, M. G. K. and Rao, S. V. , Functional distribution in the large scale manufacturing sector in India, 1962
[9]. Balakrishnan & Pushpangadan 1994: Balakrishnan, P. and Pushpangadan, K., Total factor productivity growth in manufacturing industry: A fresh look., 1994

[10]. Trivedi 2011: Trivedi, P., Lakshmanan, L., Jain, R. and Gupta, Y.K. , Productivity, Efficiency, and Competitiveness of the Indian Manufacturing Sector, 2011
[11]. Ismail et al 2009: Rahmat Ismail, Aliya Rosa, NoorasiahSulaiman, Globalisation and Labour Productivity in the Malaysian Manufacturing Sector, 2009
[12]. Phusavat 2006: Phusavat, K. and Photaranon, W, Productivity/performance measurement case application at the government pharmaceutical organization, 2006
[13]. Khazabi 2008: Khazabi, M., 'Knowledge-based labor productivity improvements: Canada case study, 2008
[14]. Akyüz, G. and Kuruüzüm, O..2011.A modelling approach in process industry for improving manufacturing performance:.:
[15]. Noruzy 2011: Noruzy, A., Hayat, A.A., Rezazadeh, A., Najafi, S. and Hatami-Shirkouhi, L., Factors influencing the productivity of knowledge workers: a case study from an Iranian oil company', 2011
[16]. Razak 2011: Razak, I.H.A., Kamaruddin, Sh. and Azid, I.A., 'Implementation of the workforce competency model for assessing maintenance worker's performance, 2011
[17]. Phusavat et al 2012: Phusavat, K., Nilmaneenava, S., Kanchana, R., Wernz, Ch. and Helo, P., Identifying productivity indicators from business strategies' surveys, 2012
[18]. Jeong & Phillips 2001: eong, K-Y. and Phillips, D.T., Operational efficiency and effectiveness measurement, 2001
[19]. Shepard & Clifton 2000: Shepard, E. and Clifton, T., Are longer hours reducing productivity in manufacturing?, 2000
[20]. Jorgenson & Griliches 1967: Jorgenson, Dale, and Z Griliches., The Explanation of Productivity Change, 1967
[21]. Bulent 2003: Bulent Unel, Productivity Trends in India's Manufacturing Sectors in the Last Two Decades, 2003
[22]. OECD.2001.Measurement of Aggregate and Industry-level Productivity Growth:.OECD Publishing:
[23]. Kumar, 2014: Kumar, R., Industrial Development of India in Pre and Post Reform Period, 2014
[24]. Economic Survey, 1998-99: National Informatics Centre for Ministry of Finance, Government of India, Review of Developments, 1998-99
[25]. JJ Thomas, 2013: Jayan Jose Thomas, The crisis in Indian Manufacturing Sector, 2013
[26]. ILO 2014: , ransitioning from the informal to the formal economy,
[27]. Nagaraj R..2020.nderstanding India's economic slowdown:.Academic Foundation, New Delhi:
[28]. Krishna et al. 2022: KL Krishna, Bishwanath Goldar, Deb Kusum Das, Suresh Chand Aggarwal, Abdul Azeez Erumban, Pilu Chandra Das, India Productivity Report, 2022
[29]. Rodgers 2020: Rodgers G., Labour and Employment in India: A 50- Year Perspective, 2020
[30]. Kochhar 2006: Kocchar K., India's pattern of development: What happened, what follows?, 2006
[31]. OECD 2008: OECD, Compendium of Productivity Indicators 2008, 2008
[32]. Dieppe 2020: Dieppe, A. (Ed.), Global Productivity: Trends, Drivers, and Policies, 2020
[33]. Basu 2012: Susanto Basu, Productivity and the welfare of nations, 2012